



THE HISTORY OF THE UNITED STATES







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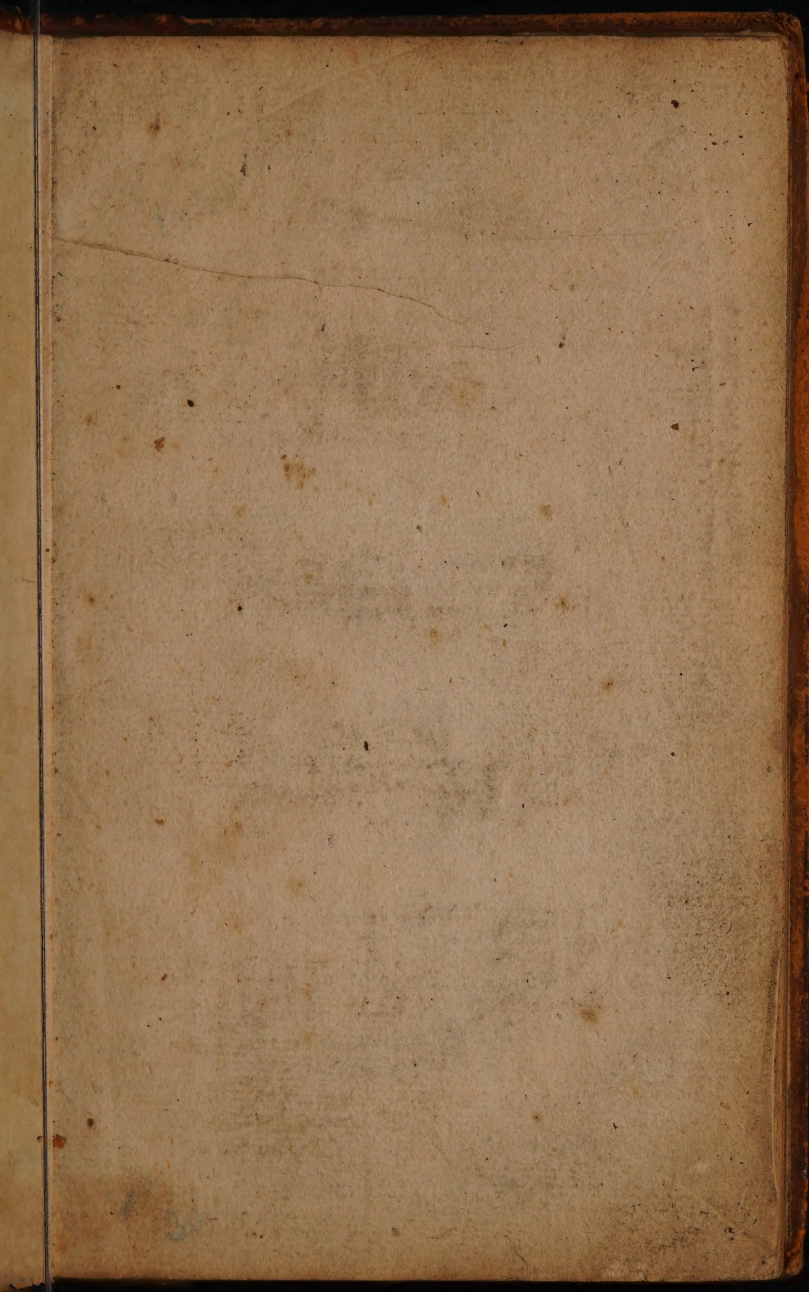
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This discourse began with in ye 46th year
of the author's age viz. 1711
to add to this period year Aug. 1711
38 years & 9 months the learned
now living must be about the same
fourteen.

Suppose the Father of the age of 16
when he went to Cambridge, add 30
since he went thither, & since 28
Sum — 74

A N
E S S A Y

Towards the Recovery of the
Jewish Measures & Weights,
Comprehending their Monies;
By help of Ancient Standards, compared with ours of *ENGLAND*.

Useful also to state many of those of the
Greeks and *Romans*, and the *Eastern Nations*.

By *Richard Cumberland, D.D.*

Ex aedibus Lametn.
O⁸. 12. 1685.

I M P R I M A T U R.
Jo. Battely, R.Rmo. P.Domino
Wilhelmo Archiep. Cantuar.
à Sacris Domesticis.

L O N D O N :

Printed by *Richard Chiswell*, Printer to
the *Royal Society*, at the *Rose and Crown* in
St. Paul's Church-Yard. MDCLXXXVI.

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To the Honourable

SAMUEL PEPYS *Esq;*

Secretary of the Admiralty
of *England*, and Presi-
dent of the *Royal Society*.

S I R,

B Ecause the Im-
provement of Na-
tural Knowledg,
for which the
Royal Society was founded,
may be attained in some de-
gree, by recovering some
parts thereof, which the An-
cients had, but are now un-
A 2 known;

The Epistle

known ; I thought it not improper to present to you, who deservedly preside in that Illustrious Society, this Attempt, to restore those eldest Standards of Measures and Weights, which are mentioned in the most ancient Records, the Sacred Scriptures, as commonly known when they were written. But such hath been the ignorance and carelessness in these Matters, of many intervenient Ages, by whose care these things should have been transmitted to us their Posterity, that most of our late diligent Enquirers have declared their Opinion

nion to be, that tho the retrieving of them be highly desirable, yet that success in such an endeavor is scarce to be hoped.

Nevertheless, being desired by some Learned Divines of our Church, in subserviency to some brief Annotations on the Bible by them intended, to do the best I could in this Affair; I have by this Treatise attempted to rescue this most ancient and useful Piece of Learning, from the Grave of Oblivion and Neglect, into which many despairing Men were casting it, before it was quite dead, or past recovery.

A 3 Learn-

The Epistle

Learning I call this Knowledge of Weights & Measures, because the first Constitution of them, and the Reason, and Proportions contained in their mutual Correspondencies, do import; not only prudent Observation, which is Learning's Foundation; but also some Elements of Geometry, Arithmetick, and Staticks, (which are essential Parts of its Superstructure) thence peculiarly called $\mu\alpha\theta\eta\mu\alpha\tau\alpha$, or the Learning. And for this cause I have been forced, in the prosecution of this Enquiry, to call in to my assistance some of the easiest Ma-

Dedicatory.

V

Mathematical Notions, which are as old almost as Mankind; associating thereunto some Observations of Nature; whose constancy from the beginning gives reason to believe, that they were known early by Men, together with the eldest Works of Art remaining in the Pyramids, Shekels, and other remains of Eastern and Western Antiquity; that from the concurrent Evidence of these Aged Witnesses, I might be enabled to give this my Verdict, which is now brought in before you.

Ancient I may well assert

A 4 this

The Epistle

*this kind of Learning to be, since it appears by Moses's Description of the Ark by its Measures, that the Cubit was in use before the Flood. And amongst the Kingdoms founded after the Deluge, Egypt will claim very great Antiquity, being by Scripture called the Land of Ham; whose Son Mizraim is found in the eldest Monuments of Time, in the Head of its Kings. But here, Proclus assures us, the Art of Measuring was cultivated in the eldest Times; whence we justly conclude this to have been part of
that*

10-10

Dedictory.

VII

that Wisdom of the Egyptians, in which St. Stephen affirms Moses to have been universally skilled.

The great Difficulty of finding out the exact Truth in this Case, that is perplext between the despair of many; and the contrariety of Opinions of other Authors; will plead sufficiently for the Pardon of such Defects, as after my utmost Endeavour, to clear this matter by decisive Evidence, both a Priore, and a Posteriore, may yet be discovered in this Discourse by your piercing Eyes; or by the curious Examination of the
Mem-

The Epistle

Members of the Royal Society, to whose Censure I willingly submit it.

Nevertheless I cannot but hope, that this Essay of mine, will be kindly received by you, even on account of your constant love to its Author. For that good Affection being begun in your Youth, thirty Years ago, in Magdalen-Colledg in Cambridg, you have continued to this day, while you have gradually risen higher in the Favour of our two Great Monarchs successively. And I may justly reckon, that nothing can break that Friendship,

Dedicatory.

ix

ship, which so great Advantages of Preferment, on your side, doth not abate.

Besides, I believe this Book will be the more welcome into your choice Library, because the Subject of it, is not any quarrelsome Interest, or distinguishing Tenet of a Party of Men, but the peaceable Doctrine of Measures and Weights; which in their General Nature, are the Common Concern of all Mankind; as being the necessary Instruments of just Dealing, and fair Commerce between all Nations; which the Admiralty of England (wherein

The Epistle

(wherein you are so highly trusted) doth promote in Times of Peace, as it secures our Safety in Times of War. For I may without any arrogancy affirm, that not only the Principles and Method of this Discourse, do give Light to that General Doctrine; but also that the particular Measures and Weights therein stated, have an universal influence thereupon. Because these being the most Ancient and Sacred Examples of that kind, and the Rules of that Righteousness, whereof Noah, the Father of all Men now living,

Dedicatory.

XL

living, was a Preacher; it's highly probable that all Nations did derive as their Pedigree from him; so their Measures and Weights from the imitation of his, (although length of Time, neglect and corrupt Customs, have made great Alterations) which I have briefly proved by the Examples of those used by the most Learned Nations, the Greeks and Romans.

But whatever the Success of my Labours may be as to the Subject or Matter of this Tract, I am secure, that the calm manner of my writing

The Epistle

ting it, will be very agreeable to the known Candour and Serenity of your Temper: For I have industriously avoided all appearance of Contention against any Man that may herein differ from me, so far as not to name the known Diversities of Opinions of Men about this Matter; and have employed all my Diligence to prove mine own Assertions, either by Arguments peculiar to them; or by shewing the Approach of Others, of the best Reputation, to agreement with me.

By this means, and by refusing to make special application

Dedicatory.

XIII

tion of the Generals here stated, to the many Texts of Scripture whereunto in the Annotations they must be applied; I have contracted my Thoughts into so small a Book, that it may seem incongruous to present it to a Man of such great Worth as you are: For which I shall add no other Apology than this; That if in this little Room mine Undertaking be not well performed, the shorter Follies are the better; if it be, I know you will not think the worse of a Book, because in a few Sheets it determines many and great
Diffi-

The Epistle, &c.

Difficulties. However, if
it were never so great, and
never so well written, I
should think it insufficient to
answer those great Obliga-
tions under which I am to
be,

Honoured Sir,

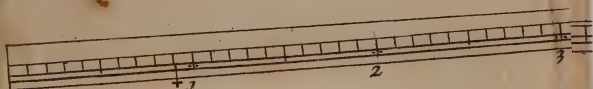
Your most humble

Servant,

Octob. 28.

1685.

Ric. Cumberland.



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with some more

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the half Cubit.

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make a Palme.



OF

Scripture-Weights and Measures.

CHAP. I.

*The Reasons, general Principles and
Method of this Enquiry.*



THE knowledg of Jewish Measures and Weights, hath been so much neglected by most Men; partly, as exceeding difficult, if not impossible to be attained; partly, as not necessary: that I cannot hope to persuade the generality, even of Scholars to study it; but find it needful rather

to give an Apology for this attempt to search them out.

I observed a considerable part of the old Testament to be employed in describing carefully the Measures of *Noah's* Ark; of the Tabernacle; and the Ark of the Covenant therein kept; of *Salomon's* and *Ezekiel's* Temples; with their several parts, and sacred Utenfils thereunto appertaning. I perceived therein the most antient, beautiful, and magnificent proportions of Architecture to be recorded; and the usefulness of such Buildings to maintain God's publick Honour and Worship to be suggested. I could not but observe, that near a thousand Years distance from *Moses*, *Ezekiel* requires the true old Cubit, *Epha*, *Shekel*, and *Gerah*, to be used at the Restauration of the Church and State, by him prophesied of.

These appearing in the Text to have been so long kept unaltered; I thought they, or some of them, might be spread into other Places, and by the careful methods of God's Providence, or the diligence of the Learned, especially Teachers of his Church, among

mong the Jews or Christians: that the memory of them might be preserved above 1000 Years more, in order to our more satisfactory understanding of the old Testament, which was written for the use of the Christian Church to the end of the World, *Rom. 15. 4. 1 Cor. 10. 11.*

I was confirmed in these hopes, by considering that the Roman Foot Quadrantal and Congius in Measures, and their Ounce and Pound (as *Vilalpandus* proves) in weight, have continued near 2000 Years. And I saw reason to believe, that the Egyptian Cubit had been preserved there, from the utmost Antiquity of the Pyramids unto this day.

Moreover, I considered, that this Enquiry was the fitter for a Minister of God's Church; because the Priests were antiently appointed to be Keepers of the Standards, or Overseers of all Measure and Weight, *1 Chron. 23. 28, 29.* Wherefore, for exercise of my Arithmetic and Geometry; I resolved, in my younger days, to try what service they could do me in this Search: and having made then some progress

in this Study, I have been perswaded now to add my riper Thoughts thereunto, for the service of a Commentary on the Bible, designed by some Learned Clergymen of our Church.

The Principles on which I proceed are,

I. Standards of Length and Capacity, that may still be seen, and compared with ours: to which I joyn Antient Shekels, which being both Weights and Coins, are presumed to have been tried and found agreeable in the Ballances with Standard-weight; and therefore are to our purpose equivalent to Standards: all these attested by credible Persons, who have seen them, and compared them with ours.

II. Arithmetical Principles of Reduction, which are demonstrable, and acknowledged true by all competent Judges. The first Principle bears upon Sense, assisted by Mechanical Geometry; the second upon Reason, used in the most simple and abstract Objects thereof, *viz.* Number and Measure. The

The Method I have taken is most natural.

1. To consider the Measure that relates to meer Length, the first or most simple Dimension, which determines Breadth; also, if the length of two sides of a Parallelogram be given.

2. Hence to proceed to Measures of Capacity, which have three Dimensions.

3. Lastly, to consider Weight, which supposes a solid Body; but superadds the notion of Gravitation in a Ballance, wherein two heavy Bodies are compared.

Asto a standard of Length, I considered, that although the Ancients often speak of the breadth of Barly-Corns to determine it by; and might probably use them at first to determine a Digit by six of them, as the first perfect Number; and then by Nature's four Fingers on a Hand, come to determine a hands-breadth, and by six of these, a Cubit: yet they must necessarily find, in the first Age, as now, variety, or inconstancy in these Productions of Nature; and therefore must soon

see a necessity of settling a Standard-digit, Hand-breadth, and Cubit; either by mutual Agreement, or rather by the Authority of the Father of the Family, the most natural Governour.

Accordingly we find a Cubit mentioned in the building of *Noah's Ark*, by which all its Dimensions are determined; and a great number of equal Cubits must be put into the hands of the multitude of Workmen, which must be employed in building so great a floating Vessel or Ship; and their Cubits must be made to agree to some Standard, or common Measure; else the parts of it would be unfit to join to each other, and could not be made to serve the common End of them all, the preservation of *Noah's Family*, and the other living Creatures therein to be included.

This Agreement of the Oriental Measures in their Digits, and consequently in their Palms; and Cubits of the same number of Palms; is expressly delivered by *Abulfeda*, in words cited by *Greaves*, in the Preface to *Abulfeda's Description of Chorasmia*, which

which he hath set out: where although he acknowledgeth, that Cubits of eight Palms were used by the Ancients, and of six by later Writers; yet he affirms, that in their Digits they all agreed, and their Miles and Parasangs determined by them, were just the same, although expressed in a less number of Cubits, when they used a Cubit of eight Palms; and in a bigger number of Cubits, when they used that of six Palms.

On these Grounds I judged, that if we could recover one old Eastern Standard Cubit, of a known number of Hands-breadths; we should be able to determine all their Measures of length by that Standard. Such I conceive and think I have prov'd the Egyptian *Derah*, or Cubit, still kept at *Cairo*, to be; whose length is evidently six Palms. And this Mr. *John Greaves*, Astronomy-Professor at *Oxford*, in his Book of the *Roman Foot*, hath given us accurately adjusted, to the 1000 part of our English Standard-Foot. What use this very Learned Man intended to make of this Egyptian Cubit, I find not; but hear-

tilly wish that he had liv'd to finish the Work he intended, about the Measures and Weights of the Ancients. The Jewish Cubit he hath nowhere stated that I know of; only in his Epistle Dedicatory to Mr. *Selden*, he intimates it to be investigable by help of the Roman Foot: how he thence could have deduced it, I know not. But since his Death, hath deprived us of that great help, which we might have expected from his great Reading, Travels, Diligence, and Judgment; I have thought fit to single out this Cubit, from those many Foreign Measures which he hath with equal care adjusted to our Standards; and to try, by comparing it with the best Notices of the Jewish Cubit, which my Reading hath suggested; whether this may not prove of the same length, with the Cubit of the Sanctuary.

In the second place I have endeavour'd to state the *Epha*, and other Jewish Measures of Capacity; deducing it from,

1. A fixt proportion to the Cube of the Cubit.

2. From the proportion of a known part thereof to the Standard *Congius* of *Vespasian*, still at *Rome*: Besides other useful Methods from the Capacity of Eggs, which the *Rabbins* much insist on; and from the Weight and known Number of solid Inches of Water, that would fill either it, or its known aliquot parts.

Only I think fit here to advertise the Reader, that he is not to be offended, if he find some difference in the issue of the several Methods of investigating the *Epha*: because in all, I pretend not to Mathematical preciseness in determining it; but in some have stated it as thereabouts. Yet observe that the finding it by the soild Inches of 1000 Ounces of Water, which is the least, doth not differ a Pint from the biggest Content, deduced Mathematically from the Cubits Cube. And this small difference might arise, either from the neglect of Workmen, makers of Measures, who in making an *Epha* by Cubit-Measure, consider'd not the
Cen-

Centesimal parts of an Inch in the Cubit, as my Account doth: or else I may affirm that the Rain-water of those hotter Countries is lighter than our Fountain-water is; and therefore a thousand Ounces of such Water would fill up more solid Inches of room, than so many Ounces of our Water doth: and by either of these ways, the difference of the Accounts may be fully reconciled, or by the concurrence of them both.

Lastly; I descend to consider *Shekel*, and both to state its Weight exactly, and thence to deduce other Weights, and their Value in our present Coin. To which I shall say nothing here, having produc'd, I think abundant evidence in that Chapter, which by help of the harmony in the last Chapter will prove all the other.

By help of this method, I have endeavour'd to make this Doctrine, hitherto very intricate and uncertain; more easy, exact, and uniform than I found it; constantly reducing all our Measures of Length and Capacity to Inch-Measure, with its Decimals; as more commonly understood than Foot-Measure:

Measure: reducing also Weights rather to our *Averdupois*, with its Decimals, than to the *Troy Ounce*; because I have prov'd the *Ounce Averdupois*, to be exactly equal to the old Roman Ounce, and to be just equal to two Jewish Shekels, the conjunction of two Shekels, I believe, is the true original of it.

By this means, the several parts of this Enquiry, will help to illustrate and prove the truth of the other; the Measures of length will clear those of Capacity: and both of them may be proved or restored by help of the Weights. Only its requisite that the Student hereof should be acquainted with Decimal Arithmetic, and a little Geometry; otherwise the necessary Reductions, and some reasonings here made use of, will not be fully understood: However such Mathematical Reasons may safely be supposed true, because they have been examined and found so, by the most competent Judges in these cases.

C H A P. II.

*Of the Ammah, or Jewish Cubit, with
the Measures thence determined.*

MY designed Method obliges me in this Chapter to do three things:

1. To shew, that the present Egyptian Cubit, is their old one, continued to this day.

2. That the Jews Cubit, or *Ammah*, was of the same length with the old one of *Egypt*.

3. To deduce the length of other Jewish long Measures from hence.

1. This being now in possession, is favoured by presumption that it was so always, or in *Moses* his time; unless the contrary be shew'd, and the time of the change can be sufficiently proved. But of such change, or introduction of a new Cubit into *Egypt*, I cannot find the least intimation in History: on the

con-

contrary, we find it asserted by the *Arabians*, *Patricides*, and *Elmacinus*, and the *Nubian* Geographer, whose words may be seen in *Hottinger's Smegma Orientale*, and other Proofs in *Kircher*; that the *Nilometrion*, or Column divided into Egyptian Cubits, to measure the increase of the overflowings of *Nile*, are as old as the time of *Joseph's* Regency there; yea, and that he first made them. Now because the same height of its increase, viz. about 16 Cubits, is agreed in all Ages (*Herodotus*, and the latest Writers, consent herein) to have been necessary to the fruitfulness of *Egypt*; it follows, that this Cubit must all along be the same; sixteen lesser Cubits would be insufficient, bigger would be prejudicial. Here we have a natural necessity to keep to the same measure from the time of its first Constitution; and this natural Reason is a thing of so great consequence to the welfare of a whole Kingdom, that none can be thought of, sufficient to move any Governour to alter it; nor can the inferiour People have any cause, or any ability to make such alteration; the Publick Standards
being

being so religiously kept; first in the Temple of *Serapis* (besides on the *Nilometrion*) and afterwards in the Christian Churches.

Hereunto we may add, that which *Proclus* hath suggested concerning the Necessity and Antiquity of Geometry among the Egyptians, that *Nile*, by its Annual overflow, used to cover with Mud the common Boundaries of Mens Land, *viz.* Stones, and Trenches, or Ditches; whence it became necessary to them, to determine, preserve, and recover each Man's proper quantity thereof, by exact measure of its Area or Surface; which must be found, by knowing the length of the Sides, and of the Perpendiculars of Triangles; or of Rectangular Parallelograms, into which any Plot of Ground may easily be cast, to which purpose they must necessarily study the first Elements of Geometry. But I must add, that they must also necessarily fix, and Reason would advise them to be constant to, some Standard-measure of length; by the Repetition and Parts whereof, they might determine the lengths of the
sides

sides of those Figures that contained their land. And we know also that their Cubit was their primary Measure: By this they settled the length of their $\chi\omicron\upsilon\nu\theta$, which *Herodotus* mentions as used in Survey, because consisting of a known number of Cubits, it saved the repeating of a Cubit so often, and was easily resolved into the number of which it did consist. Wherefore to make any change in their Cubit would have been very unadvisable; and apt to endanger loss in all sorts of Mens Estates, which had been settled by another Cubit before. And such change could never be necessary; because the first settled Cubit, and its Parts, would certainly attain all the Ends of exact measuring, as well as any other Cubit that could be introduced; and might justly challenge to be preferred before any later, by its being settled and in possession already.

The Strength of this Reason may be understood more clearly by help of an Example, which I remember in *Herodotus* his *Euterpe*. There he tells us, that in *Egypt* their settled Militia consisted of these two
sorts

forts of Souldiers, (who were esteemed above all Tradesmen) the *Hermotybie*, and the *Calasiries*: The full number of the latter of these was 250000 Men, who in courses were their Kings Guards, and every one of them had to maintain him and his Family, Land (free from Taxes) whose *Ared*, or Superficial Content, was 12 *Aroure*, each *Aroure* being 100 Cubits on every side; which imports that it was the Square of an 100 Cubits. Wherefore to know how much Land this was in our Measure, I took the *Cairo* Cubit an hundred times, which is 182,4 in our foot-measure, as may be inferred from Mr. Greaves his Table: and by squaring this Number, I find an *Aroure* to be 33269,76 Square Feet English; which is considerably less than one English Acre, for that contains 43560 Square Feet. Hence it will follow that 12 *Aroure* will amount to 399237,12 Square Feet. And this divided by the Feet of an English Acre, will quote 9,165: which demonstrates that the Land of each *Calasiry* amounted to 9 English Acres, and ,165 Milleffimals of an Acre,

OF

v. Herodotus
lib. 2. c. 142
p. 144. cl
p. 155. l 2
c. 168. in
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par-off.

square yards
4640.

or 1 tenth part of an Acre, 6 Cents, &c. above the 9 intire Acres : And it's clear that so much good Land lying where he places it, might maintain any of them with his Family very well. But if this Cubit were changed, whereby so many thousand *Estates* were set out, it must needs make a great change in all these *Estates*, consisting of so much Land set out by this first number of Cubits ; which are now supposed to be all altered, and great disorder must be expected among these Men in whom the strength of the Kingdom chiefly lay. For if a longer Cubit were taken, those of them that were first served, would have more Land in each *Aroure* ; but then there would be none left for those that should come to be served last ; or else they must trespass upon the Land that did not belong to the Militia, which would beget Discontent and Sedition : if they took a less Cubit, this would lessen all the Souldiers *Estates*, more than any Man unskill'd in Geometry can expect, and would beget a Mutiny, for want of a sufficient Maintenance for the Souldiers and their Families,

C

milies, as may appear by this Instance: Suppose that instead of the *Cairo-Cubit* the *Aroure* of the *Calasfaries* should be set out by the Roman-Cubit, which is not quite 4 Inches shorter, amounting, in our English Foot-measure, to 145, as may be inferred from Mr. *Greaves* his Table. An hundred such Cubits are 145 Feet, and the Square thereof making an *Aroure*, would be 21025 square Feet, and 12 such *Aroure* would be 252300 square Feet, which amount to little above 5 Acres, and three quarters, or Roods. Whereby its evident that much above a third part of every Souldier's Estate would be taken away; whence nothing less than great Distress in all their Families, and Rebellion against their Governors must be expected.

Concerning the Antiquity of these *Aroure*, I cannot find when they were introduced into *Egypt*; For though *Herodotus* do not mention them till he speaks of *Apries* King of *Egypt*, whom Chronologers agree to be that *Pharaoh* who is called *Hophra* in our Bibles; yet he supposes them settled on the Military Men before his Time, and

con-

Gen. 44. 30.

confines them to twelve of those *Nomi*, which are Shires or Præfectures in *Egypt*, of which *Sesostris*, the most Martial King of *Egypt*, was the Author or Founder; which makes me conjecture that he settled these *Aroure* on the Souldiers, as well as that Division of the whole Land into 36 *Nomi*. If this be admitted, they were much elder than *Moses* his Time, according to the first Book of *Eusebius* his *Canon Chronicus in Græc.* where he from *Africanus*, and he out of *Manetho* the Egyptian Priest, places *Sesostris* in the twelfth *Dynasti*, and afterwards places *Moses* in the eighteenth. Yet they will be of Antiquity sufficient to my Concern, if *Sesostris* settled them about *Moses*'s Time; to which the Learned Bishop *Usher* makes *Sesostris* contemporary. But however this be stated, when I compare 100 Cubits, the side of an Egyptian *Aroure*, with 1000 Cubits, the side of the Side of the Levites Glebe-land in their Suburbs, and observe the decuple proportion exactly kept between them, I cannot but think both these Measures were used in the same Age; and that

C 2 the

p. 59

the way of setting out Land in the Jewish and Egyptian Countries, was near of Kin to each other, which serves my main End; although it be more than I was obliged to prove in this Paragraph, where I undertake only to evince that the Cubit in *Egypt* could not easily be altered, without making great disturbance, or making new Measures to all their Estates hereby determined, which I suppose I have prov'd.

Besides, if it had been altered, it's reasonable to presume it must be by some of the great Empires who conquer'd *Egypt*, who would have introduced their own Cubit: but that was not done, for the Babylonian Cubit of five Palms is shorter, that of six Palms the same with this (as we shall hereafter shew) and so need-ed make no alteration. The Greek and Roman Cubits are known to be shorter also than this: and the Turks, under whom they now are, have not introduced their Pike, corrupted of $\pi\alpha\chi$'s or Cubit; for whereas there are two Standard-Pikes at *Constantinople*, they are both much longer than this
now

now at *Cairo*, as may be seen in *Mr. Greaves* Table of *Measures*, compared with the Roman & English Foot.

I shall add, as over-weight, to conclude this first Assertion, a probable Argument founded upon this probable Principle; that the Ancient Architects, being left to their liberty of designing the outmost Lines of a stately Building, would chuse to determine them by some round even Number of the most known Measure whereby they wrought. So God himself design'd the Ark's Dimensions in such numbers of Cubits; its length 300, its breadth 50, its height 30; all round even numbers: the like even numbers we find chosen in the measures of the *Temple*, 2 *Chron.* 3. 3. length 60, breadth 20 Cubits; and the Oracle a perfect Cube of 20 Cubits in length, breadth, and height, 1 *Kings* 6. 20. So the Learned *Greaves* found the Marble Stones of the Pavement of the most accurately built *Pantheon* at *Rome*, the larger of them precisely three Roman Feet, the less of them just half so much: which shews they took care to determine them precisely by their

C 3 most

most known Measure, the Foot, or its most obvious part, the half Foot; and though the Number be not even, yet constant respect is had to even Feet, or equal division into Halves. Such respect therefore I hoped to find the old Egyptians to have had to their Measure the Cubit, in building the greatest Pyramid, and in determining the outward Measures of the Tomb contained in it.

Wherefore, remembring that Mr. *Greaves* had given us exactly in our English Foot-Measure, the sides of the Base of the greatest Pyramid; and the length of the Tombstone contained in it, both which fall into odd Numbers and Fractions of our Measure, by which they were not designed; I resolved to try the Reduction of this Foot-measure (which he had taken) into *Cairo-Cubits*, and I found them both to fall into round very convenient Numbers of *Cairo-Cubits*; making very reasonable allowance for such small error, as may justly, or rather necessarily be supposed to have fallen out; either in the first measuring of the Pyramid's Base, or in the late
mea-

measuring which Mr. *Greaves* performed, and I least suspect.

Particularly, First, the sides of the square Base of the greatest Pyramid are delivered, p. 68, of his *Pyramidographia*, to be 693 English Feet. For reduction these must be divided by 1,824, which is his length of the *Cairo-Cubit* in our foot-measure, the quote is, 379,934, which is so very little short of 380 *Cairo-Cubits*, that I think it reasonable to believe, that the old Architects designed just this even number of Egyptian Cubits. For if we suppose Mr. *Greaves* to have missed but 12 of a Foot, which is not one Inch and an half in taking this long Measure of near 700 Feet, then the side must be put 693,12: this Number divided by 1,824, will give precisely, 380.

Or rather, if we suppose the old Architects Cubit to have been but one thousandth part of a Foot shorter than the present Standard (and such error is scarce perceptible by Mens Eyes, and there is greater difference in allowed Measures try'd by the Standard, and ordinarily used) its demonstrable that such a Cubit being

repeated 380 times, would make the side of the Base shorter than now it is found ; for 380 multiplied into 1,823, produceth but 692,74, which is shorter than Mr. *Greaves* hath found it. Wherefore since such small difference from Mathematical Exactness of Computation must necessarily fall out, in designing such vast Foundations, either from imperceptible difference in the Measure applied, or from inequality of Ground, or oversight of Workmen; I conclude, that the Measure at first intended, was just 380 Egyptian Cubits. And I incline to it the rather, because the Square of this Number, which is the *Area* of the Pyramid's Base, is as remarkable a Square as can be pitch'd upon in the whole Table of Powers of Number, viz. 144400, and might therefore more easily please the mind of the Designer.

2. In like manner I remembred, that *Greaves*, p. 96, 97, gives the length of the Exterieur Surface of the Tomb, contained in the midst of the greatest Pyramid, to be in our Foot-measure 7,296. This reduced into
Cairo-

Cairo-Cubits, by dividing by 1,824, gives just four such Cubits: and if there be found a difference in the Millesimal Parts of the Foot-measure, (which I cannot now correct, having not the Book by me, but my own Notes taken out of it) I am sure it is less than a Barly-corns breadth.

Wherefore that Tomb, or Stone-Coffins length, may reasonably be judged to have been designed just four of their ancient Cubits. And this designment could not agree so exactly with the same number of their present Cubits, unless the old Measure had been continued unto this day. Thus this Tomb will preserve to us the old Egyptian Cubit, four times repeated, as the Monument of *Cossutius* at *Rome* preserves the old Roman Foot: but with more significancy concerning the usual proportion observed of old in humane Bodies; that in most comely shaped Bodies, the length, from the Elbow to the Fingers end (called a Cubit) being four times repeated, gives the Stature or Tallness of a Man. And the difference between the length of the hollow part of this Coffin, fitted

ted to his Body that should lie therein; and the length of its exterior Surface might instruct the beholders how much shorter he was than those elder and taller Men, from whose Arms, it's credible that the Egyptian Cubit was taken at the first; this difference was very near an English Foot.

Upon review of both these Instances, I cannot believe that the old Egyptian Builders of this Pyramid and Tomb, could make them by chance to agree with such well-chosen even Numbers of the *Cairo*-Cubit, if the same Measure had not then been in use, and had not guided them in their Work; it being scarce possible that they should design and work by some other Measure, and pitch upon other fitting Numbers of such Measure, and yet that the Work remaining should so justly agree with both other well-chosen Numbers and Measures, and with these also.

For proof of the second Proposition, *viz.* That the Jews Cubit was of the length or measure with the old (or new) Egyptian, I offer some general

neral Evidence from Historical Observation of these and older Times; useful to this and other Measures.

2dly, Particular Evidence.

1. The Mosaical History assures us, that the Jews Progenitors went into Egypt, a then flourishing Kingdom, in the condition of a Family of about 70 Men; and were there Subjects at the best; who must use in all Commerce, the legal Measures of the Kingdom in which they dwell; and not long after were made Bondmen, who cannot be supposed to be allowed to make Laws to keep distinct Measures and Weights from the Nation which they serve. This little and low Estate they were in about 200 Years before their deliverance, and therefore must needs know the Egyptians Measures; but cannot be presumed (and proof there is none) to have any distinct peculiar to themselves.

Wherefore *Moses* often mentioning in his Laws, Weights and Measures, must needs mean, and by the *Israelites* be understood to speak of such, as they knew before in *Egypt*:
for

for he never constitutes in his Law a
u new Cbit or *Epha*; and therefore pre-
sumes them to know what Measures
those words signify, by former use of
them. Now it's evident that they and
their Fore-fathers for above 200 Years
must needs use the Measures of that
Kingdom in which they were Sub-
jects, and in whose Markets they must
buy and sell for so long a time.

And certainly it was neither un-
lawful nor dishonourable, in any
comparison with Slavery, to use the
publick Measures of a Kingdom, fa-
mous for greatest skill in the Art
thereof: on the contrary, *Moses* is ce-
lebrated for being skilful in all Egyp-
tian Learning, of which Geometry
and Arithmetick, both used in measu-
ring, are the best parts.

Nor were the Jews so shy of imi-
tating Egyptians, but that they did
many of them receive a strong tin-
cture of their Idolatry, their greatest
degeneracy; and therefore would
more easily comply with them in so
lawful a practice as the use of their
Measures was.

Besides,

Besides, to take away all stumbling at this, I consider that it's highly probable that the Egyptians received their Measures from their first King's (*Mizraim*) Authority, and he received them from his Ancestors, *Ham* and *Noah* : and so, I believe, did both *Abraham's* Family receive the same Measure from *Noah*, by the hands of *Sem* ; and the *Canaanites*, with whom they dwelt before they came into *Egypt*, by the hands of *Ham*.

That the Philistines also in *Canaan*, before and after *Moses* his Time, used the same Cubit with the Egyptians, may be probably argued, partly from their descent from *Mizraim*, *Gen.* 10. 6, 14. Partly from *Herodotus* in *Euterpe* his Affirmation, that the Cubit in *Samos* (which *Bochartus* hath proved peopled from *Palestine*, i.e. the old Philistines) was the same with that in *Egypt*. For it's certain, that Mens Children, and the Colonies they send abroad, use to retain the Measures of their Ancestors.

Thus although the Jews Cubit be the same with that of *Egypt* ; yet the Israelites might use it before as well as after

after their descent thither, both receiving it from *Noah* and his Sons.

To which purpose I observe ;

1. That there is no evidence that different Measures or Weights were yet introduced into those parts of the World.

2. It's evident by the Bishop of *Armagh's Annals*, that the Kingdom of *Egypt* was founded in the Year of the World 1816, which was 190 Years before the Death of *Noah*.

Now, Civil Government cannot be supposed to be without determinate Measures and Weights: nor is there any reason to believe, that *Ham* or *Mizraim*, in the life-time of *Noah*, could be unacquainted with those which he used, or could see any cause to alter them in his Life-time. They may justly be supposed to have had occasion in that time of 190 Years, to have frequent commerce with him, and his Descendents, dwelling in other Lands: and such Commerce would be facilitated by keeping the same Measures and Weights, but would be made more troublesome by changing them.

3. It

3. It appears by the same Chronology, that from the death of *Noah*, to *Joseph*'s Promotion and Authority in *Egypt*, there were but 283 Years, in which interval no change of Measures, from what *Noah*'s Family used, is read of. And several Arabian Writers affirm, that *Joseph*, during his Regency there, set up the *Nilometron*, or Column, for measuring the Increases of *Nile*; which Column is now divided by this Egyptian Cubit, and must reasonably be judged from the first to have been divided by the same; because, in all Ages the same number of Cubits, in the overflow, have been esteemed necessary for the judging of Plenty or Scarcity like to follow in that Country. And there is reason to believe, that the Column when divided by him into Cubits, was divided according to a Cubit that had been used and known before his Time, above 283 Years; constancy in these things, being usual in all settled Dominions, is to be presumed rather than change, of which there can no proof be offered. And there are many Instances of Measures being preserv'd

And that his Regency continued 80 Years; so that from his Death to their departure out of Egypt, were but 144 Years, to Moses his Birth but 64 Years.

serv'd unaltered for a longer time than that, as we shall hereafter shew.

Now I only suggest, that the Numeration by Decads, hath been kept among all Nations, that I know of, from the eldest times of History ; and yet it's as alterable by humane Authority, or Agreement, as the Measure by Cubits and *Epha's*, &c. or as the Cize of such Measures. Now that these Measures and Weights were of elder use than *Jacob's* descent into *Egypt*, may be argued ;

1. From the Measure whereby *Noah's* Ark was designed, *viz.* round even Numbers of Cubits, and such Cubits as were used and known in *Moses* his Time, else it would have been in vain to have described its Measures by a word whose sense was unknown. And if *Noah's* Cubit had been a different Measure from the *Mosaical* Cubit, *Moses* must have reduced that into the then known Measure, before he wrote the History, which we have reason to believe he did not ; because it cannot be expected that such
diffe-

different Measure would, upon reduction, have fallen into such even round Numbers as *Moses* sets down; its length just 300 Cubits, breadth 50, height 30. The same reason holds in 16 Cubits height of the Flood above the Hills. So also we read of *Sarah's* preparing three Seahs of Meale, which are an *Epha* (the chief Measure of Capacity, and the sixth part of the Cube of a Cubit, as hereafter I shall shew) long before the Egyptian Bondage.

We have also Shekels, the Original Weight mentioned in *Abraham's* Time, both in *Abimelech's* Gift to *Sarah*, as the *Septuagint* and *Targum Onkelos* express it, *Gen.* 20. 16: and in his purchase from *Ephron* the Hittite, in the Hebrew Bible, *Gen.* 23. 15, 16. And just before *Jacob's* going into *Egypt*, his Mony out of *Canaan* passing by its Weight (which therefore must be agreed on) in *Egypt*, *Gen.* 43. 21. And there being no Mark to distinguish these Weights and Measures before the descent into *Egypt*, from those of the same name mentioned by the same Writer after it;

it is to be presumed, they signify the same quantities exactly, else the Word must be equivocal, which ought not to be presumed without full proof.

2. For special evidence of the equality of the Jewish & Egyptian Cubit, it will be requisite to reduce this Cubit to our Inch-measure, and Decimals thereof. Whereas Mr. *Greaves* hath given us it from *Cairo*-Standard, in English Foot-measure, thus, 1,824, that is, 1 Foot, 8 Tenths of a Foot, 2 Centesimals, and 4 Millesimals of the same Foot; most Englishmen will more clearly apprehend its length, when reduced thus, 21,888, that is, 21 Inches, 8 Tenths of an Inch, and as many hundredth and thousandth parts of an Inch.

A Geometric Method to exhibit to the Eye, those small parts of an Inch, as in the Scheme hereunto annexed.

The whole Line is an English Foot divided into 12 Inches; each Inch also is divided into Parts called Decimals. Only I have annexed to this Foot, a very short Line, that's but the twentieth part of an Inch, or

05, five Centesimals ; because our Foot, with this small addition, is (*proxime*) the side of a Cube, containing the true *Epha*, or *Bath*, as I have endeavoured to demonstrate in its proper place.

The first ten Inches thereof, numbred from the right-hand towards the left, are contrived so as to be the Base of a Right-angled Triangle, whose *Cathetus* is but one tenth part of an Inch high, and its *Hypotenuse* is drawn sloping from the top of the *Cathetus* to the beginning of the Base. The use of this Triangle is this ; Parallel Lines to the *Cathetus*, taken between this Base and this *Hypotenuse*, with Compasses, or observed by our Eyes, are true Centesimal or Millesimal Parts of our Inch, often mentioned in this Treatise : they are Centesimals, when taken from the just Inches of the Base ; Millesimals, when from the Decimals of an Inch. So a Perpendicular from 4 in the Base up to the *Hypotenuse*, is just 4 Centesimals : and if it be taken from 8 tenths of an Inch, further towards the left hand, the Perpendicular will be 4 Centesimals, and 8 Millesimals

small Parts of an Inch; which being added to 3 Inches, and 6 Tenths, already actually divided on the Line, will give us a precise Jewish Palm. So, 912 the Digit, and (Inches) 10,944 is the Jewish Span, or half a Cubit; and therefore being doubled, gives the whole Cubit. Wherefore these Lengths are marked in a distinct Line near the Base of our Triangle, that the reductions to Inch-measure made in this Discourse, may be more fully understood by beginners in this Skill.

Arg. 1. From the Number and determinate measure of 6 such Palms, agreed generally by Christians, Jews, Persian and Arabian Mahumedans, to constitute the Jewish Cubit: The Sum or Result of which, agrees exactly with the Egyptian Cubit now specified. Among Christians, I will only mention *Jerom* on *Ezekiel*, and elsewhere generally. The Jews may be seen cited in *Arias Montanus* his *Tubal Cain*; in *Waser*, and *Hottinger's* Preface to his Book *de Cippiis*. Persians and Arabians own this in generall terms concerning the Eastern Cubits,

Cubits, elder and later, as *Greaves* hath produced them in his Tract of the Roman Foot, and his Preface to the Description of *Chorasmia*, by *Abulfeda*.

I avoid the dispute about different Cubits; it seems to me all founded in the more indefinite signification of *Ammah*; which it's certain from the Arabic, signifies often generally any Measure, whereby the Dimensions of Bodies are adjusted. Now because this may be done by any known length divided into known parts, or repeated as need requires; it's no wonder if it were done sometimes by a Rule divided into five hand-breadths, sometimes by one of six, other times by one of eight hands breadth, as convenience might prompt. But the legal settled or sacred Standard, most properly or peculiarly called *Ammah*, or *Cubitus Verissimus*, as the Vulgar Latin translates it, in *Ezek. 43. 13*. this all agree to be of six Palms.

This proper Standard-Cubit only I took as the rule of other Measures; and I believe the Scripture always means this, when it useth *Ammah*

without any mark of distinction or limitation in the Context : for words of different significations being set alone, are to be understood in their most famous or noted sense; else there will be so much place for equivocation, that the use of all Speech and Writings, even of the Bible, will be destroy'd. And the Scripture marking out a distinction in a few places, shews it was carefully written; and that that distinction is not to be understood, where not express'd. *Non est distinguendum, ubi lex non distinguit. Exceptio firmat regulam in non exceptis.*

Particularly; I observe none intimating a difference of Cubits, but one in *Moses* his Books, *Deut. 3. 11.* where speaking of the Dimensions of the Bed of *Og*, a Foreigner from *Israel*, who therefore had no respect to the Jewish Standard, he saith, his Bed was measured by the Cubit of a Man, *i. e.* an ordinary Man, not like him; and a more precise Measure in this case was not at all needful. The other two places that intimate some difference of Cubits, are in *Ezek. 40.*

5. & 43.13. Now he writing while he was Captive in *Babylonia*, must be thought to have observed that Measure differing from the Jewish Standard, was there often used, even by the Jews also, who must use the Measures allowed in the Kingdom where they live; and therefore being to give them the Measures of the future Temple, he was obliged to intimate that the Cubits whereby they were expressed, were not such as in this Foreign Kingdom they oft used; but longer by one hands breadth.

This being premised, I pursue my Argument, by shewing, that the Eastern People determined their Digit, and consequently this hand-breadth, by the breadth of six Barly-Corns making a Digit, 24 a hand-breadth, as appears, not only by the Jews, but by the *Nubian-Geography*, *Ali Kusbgi*, *Abulfeda*, &c. taking ordinary Barly; yet the better and plumper, rather than the worse: *Optimum in suo genere mensura reliquorum*. Now six such Grains (any Man's Eyes may satisfy him) will make above 9 Tenths of an Inch English; and

although there be some inconstancy in different Grains, it may rationally be fix'd in order to a settling a Standard, at $\frac{9}{12}$ of an Inch, as a middle rate, which is sometimes exceeded by Nature, but oftner she falleth short of it; that is, the Eastern Digit may be exactly stated at 9 Tenths of our Inch, 1 Centesimal, 2 Millesimal parts thereof.

Wherefore since there be 4 Digits in a Palm, it shall be by Multiplication of $\frac{9}{12}$ into 4, 3, $\frac{6}{4}$ 8; that is, 3 Inches, 6 Tenths, &c. And the Digit $\frac{9}{12}$, multiplied by 24, produceth 21, $\frac{8}{8}$ 8, which is just the Cairo-Cubit, as was to be demonstrated.

Here observe, that this Handbreadth, and Digit, agree well enough with middle-siz'd Men among us; and these may well be kept constant in this Standard, as so agreeable, both to the nature of the Vegetable Barly, and the animated useful part of Man, which were before Standards, and these derived from them: whereas in Measures more lately constituted, as the Greek and Roman Cubit and Foot,
it's

it's manifest that they make their different Palms, and Fingers-breadth, by first fixing the Cubit or Foot, then dividing the Foot into 12 parts, and calling them, though different in the several Notions, by the Names of Fingers and Palms, to which they are somewhat near, but with great uncertainty.

My first Argument bore upon Nature's usual bigness of Barly, compared with the agreed number of Fingers-breadths and Palms in the Jews Cubit, adjusted with the Egyptian: My Second shall be from Divine Authority, of *Ezek. 43. 13.* parallel to *40. 5.* describing the Cubit the Altar should be built by, to be a Cubit and a Hands-breadth. The most natural Exposition of which place, I conceive to be this, that they should determine the Altar's Measure by a Cubit, which should contain one Hands-breadth more, than that Cubit which they now ordinarily saw and used in the Babylonians Country, where now they were Captives.

Hence

Hence I infer two things useful to my purpose.

1. That the Hands-breadth was a Measure fully known and agreed of in *Babylonia*, the same that in *Judæa*: For if they had differed in this, as they did in the usual Cubit, it had been in vain for the Prophet to describe the Sacred Cubit by an additional Hands-breadth, whose true quantity was as unknown to them, as the true quantity of the Sacred Cubit is intimated to be: he ought first to have stated a Sacred or true Jewish Hands-breadth; but he not doing so, and yet purposing to lead them to an exact Jewish Cubit, by these words implies the Hands-breadth used in *Babylon* and *Judæa* to be the same. Other Hands-breadths, as the Roman and Greek, differ considerably, as their Feet do.

2. Because it's agreed that the Jewish Cubit was just six Hands-breadths, and affirmed here to be one more than the Babylonian; it follows that the Babylonian now used, was but of five Hands-breadths in length: wherefore in our Inch-measure, if we subtract the
Hands-

Hands-breadth 3,648, from 21,888 the Cubit, the Remainder is the Babylonian Cubit 18,240, which is not a quarter of an Inch longer than ours. And the addition of this Palm to 18,24, makes the Egyptian Cubit as before: Or rather thus, 6 multiplied into the Hands-breadth 3,648, produceth 21,888.

I am confirmed in belief of such a Babylonian Cubit often used, as differed in number of Hands-breadths, but agreed in the quantity of every single one, by these things;

i. By a Testimony out of the *Misne Chilaïm*, cap. 17. cited by *Arias Montanus*; that there were two Standard-Cubits kept in *Susan*, which he refers to, one of five Palms, the other of six. And Dr. *Castle* in his *Lexicon* in *Ammah*, proves from *Jophe Toar*, that there were even in the Sanctuary, Cubits (or Measures) of 5, 6, and 10 Palms; which might all be of convenient use, for the measure of little and greater Lengths, if they agreed in the quantity of the Palms whereof they were made; because all Sums of Length measured by them, might

might easily be divided by 6, and so reduced to the settled Standard of six Hands-breadths; but otherwise such diversity of Measures must breed infinite confusion and uncertainty.

So we can find the number of our Yards in any length, as a Mile, although we measure it either with a two-foot Rule, that is shorter, or with a Pole of 16 Foot and an half, that's so much longer; but still the Standard-foot must be supposed in both of them to be fixed; only we find it convenient, both for dispatch and truth, in measuring greater Lengths, to use such longer Measures, as have in them the shorter, often exactly repeated.

2. By a Testimony of *Abulfedas*, who in the Preface to his Description of *Chorasnia*, informs us, that the Ancients used another Cubit, consisting of 32 Digits (that is, eight Palms) besides that of 24 Digits, or 6 Palms; yet this made no real difference in their Measures, because they all agreed in the Quantity of the Digits, and in the Sum of them, and consequently in the Quantity and Sum of the Palms.

3. By

3. By a passage in *Herodotus*, (who flourish'd not much above 100 Years after *Ezekiel*) in his *Clio*, describing the height of the Wall of *Babylon* to be 200 Cubits, adds for greater exactness, that they were Royal Cubits, which are three Fingers-breath longer than the μέτρον πυχός, moderate-sized Cubit.

Hereby he seems to intimate these two things to my purpose.

1. That the Babylonians had, and might most obviously have been conceived by his Reader, to have used a middle-sized Cubit, meaning, one like the Greek Cubit; for to such Readers use he wrote: but he informs them, that in determining the Wall's Height, they used a longer, called the *Royal Cubit*.

2. He informs us, that that Royal Cubit, was 3 Fingers-breadth longer than the other. Here by *Herodotus* his Fingers-breadth, I think we must understand, Greek Inches, which they called δακτύλοι, because he wrote for the use of the Greeks, who must not be supposed generally to understand the Babylonian Fingers-breadth.

This

This sense of *Herodotus* being admitted, we have here intimated all that I designed in this Argument to prove; *viz.* That the *Babylonians* had two Cubits; one of a size near agreeing with the Greeks, which differs very little from our English Cubit; and which being shorter, might be oftner used: another, a Hands-breadth longer: for three Greek Inches are somewhat more than three of ours, and the Eastern Hands-breadth we have shewed to be but three of our Inches with a Fraction annex'd, which was too nice a Matter for the Historian to take notice of.

And agreeably hereto I find, that *Almammon* the Learned *Calif* of *Babylon*, about 900 Years ago, did make use of such a Royal Cubit, consisting of six Palms, in the measuring of a Degree of a great Circle of the Earth on the Plain *Sinjar*.

The Issue of these Observations, in relation to the Text of *Ezekiel*, is this; that whereas there was a less Cubit of five Palms, often used in *Babylonia*, the Prophet informs them, that they should not determine the Altar's

Altar's Measure by his numbers of Cubits in that short one; but in the larger Cubit, called the *Great Cubit*, *Ezek.* 41. 8. which had a Palm added thereunto; and was the fitter, as agreeing with both the ancient Measure of the Sacred Buildings; and also with the Royal Standard of the Prince under whom now they were. Which Royal Cubit, I suppose to have been kept there from the Ages nearest to *Noah*; as the Egyptian, with which it agrees, we have suggested to have been settled by *Mizraim*, and derived from *Noah*.

In passing through this Argument, we have observed a near agreement between the *Babylonian* lesser Cubit of five Palms, and the Greek Cubit, which *Herodotus* supposeth known by his Readers. I will now express it precisely, that of *Babylon* in our Inch-measure, I said, was 18,24; that the old Greeks was, 18,13; the difference is not a Barly-corns breadth. And our Cubit is no more less than the Greeks.

This makes me conjecture, that the first Planters of *Greece* coming from

Asia,

Asia, brought thence that Measure : a little neglect, in process of time, might easily make those small Alterations. Agreeably hereunto I find in these Western and Northern Parts, very near approaches to the Eastern Cubit of six Palms : for such is the Ell at *Frankford* on the *Main*, at *Florence*, and at *Dantzick* ; and such is the Standard Foot at *Riga* ; as may be seen in the Table of Foreign Measures, given us by Sir *Samuel Moreland*.

Third Proof taken from the Measure of the outward Wall of the Temple, which is given by *Josephus* and the *Talmudists*, in very different Measure ; whereof *Josephus* his Measure seems to be the Jewish *Stadium*, or Furlong, composed of 400 Jewish Cubits ; and the *Talmudist's* Measure is 500 Roman Cubits ; which they may reasonably be presumed to measure by, because when they wrote, the Jewish *Polity* had been dissolved some Centuries of Years ; but the Roman Monarchy, and consequently the knowledge of their Measures, flourished. By comparing these, *Jacobus Capellus* hath stated the Jewish Cubit

to

to be to the Roman, as five is to four; which is the only way to reconcile *Josephus* with the *Talmudists*, in a Matter wherein they may both be presumed to have been good Witnesses, sufficiently skilful, careful and faithful. For proof of this Proposition of Jewish and Roman Cubits, *Jacobus Capell. de Mens. &c.* may be consulted. An Epitome of his Argument is delivered by his Kinsman *Ludovicus Capellus*, in his Discourses about the Temple, printed in our *Polyglot. Pag. 23. Col. 1.* about the middle.

That which I have to supperadd to him, is;

1. To reduce the Roman, and thence his Jewish Cubit, to our English Inch-measure.

2. To shew that his Jewish Cubit, so found, comes within a Barly-corns breadth of the Egyptian Standard; which yet I suppose he knew nothing of, but which is my main Concern to prove. These I shall soon dispatch together.

For Reduction, observe, that the Roman Foot, on the Monument of *Cossutius*, now by most thought the
E truest,

trueſt, in English Inches and Decimals thereof, is 11,604; to which if we add half thereof, we have the Roman Cubit in our Inches, 17,406. Then by *Capellus* his Proportion, as 4 is to 5, ſo is the Roman Cubit 17,406, to the Jewish 21,757. Thus his Argument, from the meaſure of the Temple's outward Wall, finds ſuch a Jewish Cubit; as wants little above one tenth part of an Inch of the *Cairo*-Cubit. And it's no wonder, if in ſuch a length as a Furlong, ſuch a little quantity be miſt (from the Cubit) which is leſs than a Barly-corns breadth: therefore I may even hence conclude, that theſe Cubits agreed.

Nevertheless I will ſuggeſt, that there is another Roman Foot a little different from the forementioned, that on the Monument of *Statilius*, which in our Inches is 11,664: if this be rather choſen, (as it hath ſome great Approvers) the Roman Cubit will be 17,496; and by the former proportion, the Jewish will be 21,87; which is nearer our aim, the Difference being only one Centeſimal part of an Inch. But the former Approach ſatiſfies me.

The

The fourth Argument shall be from the consent of some Learned of the East, if not to the Word, or particular Standard that I point at, yet to a Measure agreeing therewith, which is the thing I seek. Here I shall first mention *Abulfeda*; whom *Kircher* in his *Oedipus* cites, expressly affirming, that the Jew's legal Cubit, was equal to the Egyptian Cubit of 24 Digits, which he calls their less Cubit, in comparison with a longer Measure sometime used by the Egyptians, consisting of 32 Digits, or eight Palms. Now *Abulfeda* being King of *Hamath*, a City and Territory very near *Judea*, and not far from *Egypt*, and exceeding curious and diligent in the Doctrine of Measures in the East, I confide very much in his Testimony, agreeing with such Reason as I have before produced. But *Kircher* appears not to have known the Egyptian Standard, and therefore could not improve this Testimony of *Abulfeda*, to the determining of Scripture-Measures; and *Abulfeda* being a Mahumedan Prince, although not unacquainted

E 2 with

with the Bible, yet took no care to explain the peculiar Measures thereof, which is my Business.

Another Testimony I shall offer from a Learned Jew, Rabbi *Gedaliah*, who deduceth his Assertions from the Doctrine of *Maimonides*, who so thoroughly understood the *Talmudists*, that his Judgment may well represent the sense of all the Jews. But I take it rather from *Gedaliah* than the rest; because he, under the conduct of *Maimonides*, and other Jews, hath adjusted their Notion of their Cubit to a known Standard among us, viz. to the Standard of the Cubit or Ell of *Bononia*, where he resided. This Testimony of his may be seen cited at large, and translated by *Hottinger*, in the Preface to his Tract, *de Cippis Hebraicis*: And the *Bononian* Ell is given us reduced to English Inch-measure, by my Honoured Friend Sir *Samuel Moreland*, and by Sir *Jonas More*, to be 25,76 Inches and Decimals.

Now, *Gedaliah* affirms two things in his Adjustment:

I. That 14 Jewish Digits are equal to half the *Bononian* Cubit: Whence

I infer, that 28 such Digits are equal to the whole *Bononian* Cubit; and consequently that the *Bononian* Cubit, 25,76, being divided by 28, the Quote will be a Jewish Digit. This Quote is in Decimals of our Inch, 92, a little bigger than the Jewish Digit by me formerly assigned, viz. 912; and therefore 24 such Digits will give a Jewish Cubit somewhat longer than mine, viz. his will be 22,08, which exceeds mine a little above the breadth of a Barly-corn, viz. 2 Tenths of an Inch.

But then in the second place he affirms, that the Jewish Cubit is equal to $\frac{7}{8}$ of the *Bononian*, wanting one Digit.

To examine this, and to compare it with his former Assertion, I found it necessary to divide the *Bononian* by 8:8)25,76(3,22; and this Quote so found, must be multiplied by 7, the Product is 22,54. Hence substract 1 Digit (by his Account) 92; the Remainder is affirmed by him to be the Jews Cubit 21,62. Now, this is less than his former Account by 46, very near half an Inch; and is also

E 3 less

less than the Cubit I assign 21,88, by above a quarter of an Inch, viz. by .26.

Thus it's plain that my Length assigned to their Cubit, lies between his two Mistakes, which contradict each other; Nevertheless, I think he hath done us very good Service by the approaches to Truth, which are in both his Mistakes; and I see reason to believe, that in both these Attempts to express the Jewish by proportion to the *Bononion*-Cubit, he slipt only, through want of skill or accuracy in the Doctrine of Fractions, which if he had understood, he might have made his Accounts to agree better. However, the worst of his Accounts differs but a quarter of an Inch from me, and his other is nearer agreement; so that he differs more from himself than from me, or is nearer agreement with me than with himself. And by his so near approach to me on each side, he confirms me in my Opinion, that I have assigned a Standard sufficiently agreeing with the Doctrine of the Jews concerning their own Nation's ancient Cubit, which

which is all I undertook in this Argument.

After I had finish'd this Discourse, it was suggested to me, by a Learned Friend, that Rabbi *Gedaliah's* words, wherein he affirms the Jewish Cubit equal to $\frac{7}{8}$ of the *Bononian* Cubit, wanting one Digit, are capable of another sense than that wherein I took them, *viz.* he may mean, That a Digit---92 Decimals of our Inch, being taken out of the *Bononian* Cubit---25,76: the Remainder, which is 24,84, must be considered, and $\frac{7}{8}$ of that will be the Jewish Cubit. Wherefore divide 24,84 by 8, it quotes 3,105: multiply this Quote by 7, the Product will be 21,735 for the Jewish Cubit, which differs from mine not much above 1 Tenth of an Inch; and therefore still the more confirms mine Assertion, and brings him nearer to agreement with himself, which makes his Testimony the more valuable.

My last Argument for this Cubit, should be taken from its greater fitness to all the uses, to which a Cubit-measure is assigned in the Scripture. As

to give more convenient grandeur to the Tabernacle, to the Temple, and to those other sacred Things that belonged to God's Service in them both. But all these things will require larger Discourse than can be allowed in this Work. Wherefore I shall only instance in two things.

1. In the Height of the Table of Shew-bread, because the account of that will be very short, and yet seems clearly to favour this Measure which I have proposed. *Moses* expresseth its Height to be one Cubit and an half, *Exod.* 25. 23. This, in my Account, ariseth to above 32 Inches and three quarters, viz. in Decimals 32.83, which is a convenient height for a Table. But if we take a shorter Cubit, suppose the old Roman Cubit, its height will be, in English Measure, but two Foot and two Inches above the Floor, which seems very inconvenient for a Table.

2. In the Capacity of *Noah's Ark*, of which because the most Learned *Dr. Wilkins* hath written very particularly, I will only add this general Remark; That if instead of a Cubit
of

of 18 Inches, our Cubit which is 21,888 be admitted, the Capacity of the Ark, built according to *Moses* his Numbers of Cubits, will be very near twice as great, which will make it much more convenient for all the Ends to which it was designed. For such an Ark made by this longer Cubit, will be to its like made by a shorter Cubit, as the Cubes of these different Cubits are to each other; but the Cube of my Cubit is very near double to the Cube of 18 Inches, therefore so will the Capacity be: The *Major* all Geometricians know to be true, and the *Minor* any Arithmetician may find; therefore the Conclusion is true.

Our third Proposal, was hence to determine other Scripture and Eastern Measures of Length: Now this is easy, because it's agreed of lesser.

Inches.

- | | |
|---|--------|
| 1. That the Span, or <i>Zereth</i> , } | 10,944 |
| was half a Cubit | |
| A Palm, or Hands-breadth $\frac{1}{2}$ | 3,648 |
| A Digit, Fingers-breadth $\frac{1}{27}$ | 912 |

So

So also, 2. of their bigger Measures, *opyvix*, a Fathom, 4 Cubits, *Ezekiel's* Reed 6; *Canna*, or a Pole, was 8 such Cubits, in English Feet 14,592.

Schenus, or their Line or }
Chain, 80 Cubits — } 145.92

Iter Sabbaticum, Sabbaths }
Journey, 2000 Cubits } 3648

Their Mile, its name from } *Mil. Eng.*
Romans 4000 Cubits, } 7296 — 3816

Their *Parasang* 12000 Cub. 21888 — 4,1454

The 30th part thereof is a }
Stadium, as *Herod.* and } 400 Cubits.
Hesychius witness — }

48 hours
a Sabbath
day journey
Their days Journey not }
always equal, but at a } Cubits.
middle rate, set by *Abul.* } 96000-33,1632
feda, is 8 *Parasangs* — } v p 136 where 8
parasang. are made equal to 33,1632 Eng. miles
on the plain that begins the way

It will not be necessary for me to give the Proofs of the Proportion of these Measures to the Cubit, or to each other: this is generally agre'd on, and the common Writers on this Subject have produced them: Wherefore I have thought my self only obliged to reduce them to

our

our Standard-measure, supposing the Cubit to have been already rightly stated. And the like Method I have used about the Measures of Capacity, deduced from known Proportions to the *Epha*, and the other Weights deduced from *Shekel*.

I shall only add this Observation, That because so many Measures were determined by relation to the Cubit, the Egyptians and Jews were obliged to be constant in the Standard thereof, else the proportion to all their other Measures would be altered, and the ancient Measures of all their Lands, and best Buildings, would be greatly disturbed: as we might shew by instancing in the Levites Suburbs, set out by 1000 Cubits on each side of their Cities, and the Egyptian ἀρσῆγι, mentioned by *Herodotus*, which were determined by 100 Cubits on every side.

p. 6.
& 19

C H A P. III.

*Of the Epha, and other Measures
of Capacity thereby determined.*

MY next endeavour shall be, to find the true Capacity or Content of the Jewish *Epha*; which I think will be most exactly express'd, both by the number of solid Inches (English) of Water, which is contained, and by the number of Gallons and Pints, or known parts thereof, taken in Measures agreeing with our Standards. But both these must be found by help of the ancient Roman Standards yet remaining, to which both the Greek and Jewish Measures have been reduced by the Ancients.

For the clearing of my way of expressing the Capacity of this Measure, I must premise two things.

I. That the most exact and Geometrical way of expressing the Capacity

ty of any Vessel, or Measure, is by expressing, in known terms, the solidity of a Body which will precisely fill it; the fittest will be Water, such as drops from the Clouds, which we suppose not to differ so considerably in the several Regions of the World, as Spring-waters do. Now, the Solidity of all Bodies is best express'd by help of a Cube, whose equal sides and height we know by a Standard-Measure of length; such is a cubic or solid Inch, whose side is the twelfth part of a Foot, and a Foot the third part of the Iron Yard, kept at *Guild-hall* for the Standard of *England*.

And it appears, that this way of determining Measures of Capacity, is not only most Geometrical, but also exceeding Ancient; because the Egyptians made their *Ardob* to be the Cube of their known Standard, the Cubit; and the old Romans made their Quadrantal, the Cube of their Standard, the Foot, as both *Festus*, and the ancient Verses of *Rhemnius Fannius* witness; which I need not transcribe, being obvious in divers Writers; my design being only to shew, that the
An-

Ancients aimed at this Correspondence between Measures of Length, and those of Capacity.

And indeed, a Cube is the only regular Solid which I have observed to be described in the Scripture, by all its Dimensions of Length, Breadth, and Height; and there such cubical Dimensions are assigned (what ever is the Mystery of it) to the most Sacred Type, the Holy of Holies, *1 Kings 6. 20.* and to the most holy Antitype, the *New Jerusalem, Rev. 21. 16.*

Perhaps (because the simplest Solid hath all possible Dimensions in it) it may intimate;

1. The solid or compleat felicity of the Heavenly State, respecting the Length, Breadth, and Height of Divine Love, *Eph. 3. 18.* which is the Fountain thereof.

2. The perfect rest and constancy thereof, because the *Heārā*, or Resting-Bases of the Cube, are six, which *Euclid* hath shewed to be a perfect Number: and they are all Squares, whence the Cube is less subject to be shaken, than the other regular Bodies.

Some-

Something to this purpose is intimated in the old Maxim, 'Αὐτὸς ἀρετὸς τελέει'.

II. I premise, that amongst us English, it is agreed, that our Wine-Gallon, now most frequently used, contains precisely 231 Solid or Cubical Inches of our Standard-Measure; and our Corn-Gallon, which is the Statute-measure of Capacity in England, contains 272 such Inches: for although Mr. Oughtred affirm it to contain $\frac{1}{4}$ of a solid Inch more (which is very little difference) divers others since, upon exact tryal, see no cause to add that Fraction to its Capacity.

552, 179. a modius Romanus 552, 179

For these Reasons, and to shew the dependance of the Epha on the Cubit already stated, I shall express my opinion concerning the Content of Epha, &c. in a number of our solid Inches, and in Decimal Fractions thereof, rather than any other sort of Fractions, which are more troublesome or difficult to be understood and reduced.

I conceive that Epha was about 1747 solid Inches of English Measure, not much distant from the English Foot

Wine measure
 8 Gall 1848.
 1 Gal. 231.
 a pottle 115 $\frac{1}{2}$
 a quart 57 $\frac{3}{4}$
 a pint 28.3 $\frac{1}{2}$
 & weight 16 $\frac{3}{4}$
 Corn measure
 a Gall 272.
 a Bushel
 2176 inches
 a Peck 544.
 a pottle 136.
 a quart 68.
 a pint 34.
 a half pint 17.
 Modius
 Atticus 2484, 8
 p 76. 2454-72

Foot Solid, which is 1728; and is near the Inches Solid of 1000 Ounces of Water. Or in Wine Measure it was 7 Gallons, 2 Quarts, and about half a Pint. In Corn Measure, 6 Gallons 3 Pints, and 3 Solid Inches.

This Capacity of *Epha*, or at least for approach thereunto, I shall endeavour to prove by four Arguments.

1. From its proportion to the Cube of the Cubit of *Israel*, formerly stated.

2. From its proportion to the *Corus*, or *Chomer*.

3. From its proportion to the *Seah*.

4. From the agreement of this Capacity with the content or solidity of 432 Eggs, whereby the Rabbins ordinarily determine it.

But I confide more in the two former Arguments, because taken from bigger Measures, than in the two latter, which arise from less. And therefore have altogether omitted the investigation from Number and Weight of Grains of Wheat, which I find elsewhere used: because every
little

little Errour (which is unavoidable in small Measures) grows greater in the progress by multiplication; whereas little Errours in bigger Measures, when we pass from them to lesser by division, grow still less than the former, which tends to exactness.

Arg. 1. *Epha* is the sixth part of the Cube of the Egyptian Cubit, which Cube is called an *Ardub*: but the sixth part of that Cube, or an *Ardub*, is 1747,7 solid Inches: therefore so is *Epha*. The proof of the Major is from the express affirmation of the Arabian Accountants and Mathematicians, *Alsephadi* and *Ebn. Chalecan*, printed in Dr. *Wallis* his Arithmetic; cap. 31, and received from Dr. *Pocock*. Only there the *Epha* is by an usual commutation of the quiescent Letters, and of the Labial *p* into *b*, called *Oeba*, or as Dr. *Wallis* expresseth it, *Waibah*. But *Salmasius*, and Dr. *Castle*, and all the Learned in the Eastern Languages, that I have met with, acknowledge that *Arabic* Word to express the same Measure, that the Jews call *Epha*. And the matter
F seems

seems clear, by comparing the Hebrew *Exod.* 16. 36. with the Arabic Translation, in which *Waibah* is put to express the Hebrew *Epha*.

Add hereunto, that it may be deduced from what *Goli* affirms, treating of *Corius* as a Babylonish Measure; that at *Babylon* also the *Ardub* was equal to six *Ephas*: for he asserts 40 *Ardubs*, equal to 720 *Seahs*, which are known equal to 240 *Ephas*. Wherefore divide the number of *Ephas* by the number of *Ardubs*, the Quote will be 6; which shews that one *Ardub* is equal to six *Ephas*.

Thus this Proportion appears acknowledged wide in the East; although I do acknowledg that several *Ardubs* of different Capacity from this, are mentioned by *Kircher*, as used among the Egyptians; and other ἀγροται, stated by the Greeks. Yet this sense of the word being as fully attested, and this being determined by a sure Standard, I shall consider it only in this sense, having no use of its other various significations.

Thus the *Major* is proved by Authorities; the *Minor* is demonstrable thus.

v. Herodotus
lib. 1. c. 692.
p. 80 where
he says an
Araba of
Babylon was
not greater
an Arabick me-
asure by 3
athick cha-
n. 188.

31-21

thus. The Egyptian Cubit reduced to English Inches, hath been proved to be 21,888. This number multiplied by it self, produceth its Square; that multiplied by the Side, or first Number, produceth the Cube, which is the Content of the *Ardub* in solid Inches.

Lastly; This being divided by 6, the number of *Ephas* in *Ardub*, the Quote is 1747,7. The Arithmetical Operations need not be set down at large in this Paper, but may be tried by any Arithmetician at his leisure.

But because it is not easily credible that the Ancients, in making their *Ardub*, did consider the thousandth, or the hundredth part of an Inch (which yet I have expressed by Reduction from *Greaves* his Measure of the Egyptian Standard, that I might not willingly depart from his exactness) and because the Abatement of the Centesimals of an Inch, in the side of the Cube, will err less from preciseness, than the addition of a like quantity, and will reduce the *Epha* to a Measure so well known among us; I have expres'd it also by an English

Foot Solid; which will be found to come from the sixth part of the Cube of 21,8; for the Cube thereof is, 10360,232: and that divided by six Quotes 1726,7, differing less than two solid Inches from the Foot solid, 1728.

From this approach to Agreement, we may not only help our Memory, but also probably conjecture, that as our Foot is two thirds of our Cubit, so the Eastern People had a Measure, which we may call their Foot, which also was two thirds of a Cubit, sometimes used among them, viz. a Cubit of five Palms: Which differed not much from our Cubit, as I formerly shewed. And the Cube of that Foot of theirs, was probably the Original of this ancient Measure, the *Epha*, which a little exceeds our Foot Solid; as also such their Foot and Cubit, in length, a little exceeded ours.

However it's certain, that the excess of the Cubic-Root of an *Epha*, above our English Foot, is not quite five Centesimals of an Inch, or not the twentieth part of an Inch.

I have also observed, that the *Epha*, or *Bath*, contains just 1000 Ounces *Averdupoise*, or 2000 Shekels weight of pure Rain-water; which being lighter than our Fountain-water, and of a more constant equality in its Weight than Spring-waters are (which differ a little in weight from each other) takes up a little more room than so many Ounces of our Water will do: so that though we reckon 1726 Cubic-Inches to 1000 Ounces of our Fountain-water, we may well allow about 1747 such Inches to 1000 Ounces of their lighter Rain-water.

according to
wt. 100.3
requir. to
contain ym
172 $\frac{6}{10}$ Inch
173.22
of Inch

And it's evident that the Ancients determined their Vessels of Capacity by weight of Water. So the Roman *Congius* held just 10 pounds of Water, and that of Rain, as *Dioscorides* hath noted: their *Amphora* 80 such Pounds, their *Sextary* 20 Ounces. And it's certain, that the reckoning of Weights by round Numbers of Shekels, or their double, which are Ounces, is most ancient. And universally, that most ancient expression of *Job* 28. 25. *He weigheth the Waters by Measure*, intimates, that their ancient Measures

of Water were of a known weight, else it were impossible to weigh them by measure, or thereby to estimate and adjust their Weight. But this will be clear when we handle Shekel.

Here I thought fit to remark, that the concurrence of the Measure of this Solid Foot, and of the Weight of 1000 Ounces of Water, might recommend this Measure called *Epha*, or *Bath*, to the first Founders or Authors thereof: and this happy concurrence is the true cause, that all their Measures and Weights may be investigated and prov'd, both *à priori*, by beginning with the simplest Measure of Length, and thence proceeding till we end in the Weights; and *à posteriore*, or *per-egressum*, by beginning with the weight of a Shekel, and passing through all the Measures of Capacity, until we come to the Cubit, their Root; as I shall shew in their Harmony at the end of this Discourse.

The Reduction of this Measure to our usual Measure by Gallons, &c. is thus performed: divide 1747.7 by 231, the Inches Solid in a Wine-Gallon; the

the Quote will be 7,566 : which signifies seven Gallons, half a Gallon, or two Quarts, and about half a Pint. The like Method may be used for the Corn-Gallon. This may suffice for the first Argment, which may pretend to accuracy, because its *Major* is the affirmation of Mathematicians, referring the *Ardub*, and its sixth part, the *Epha*, to a known Standard, the Egyptian Cubit; and the *Minor* is certain by true Calculation. Those that follow pretend not so high, yet are of good moment, because they make some approach of agreement herewith; and many Witnesses agreeing in the Main, do corroborate each others Testimony.

Arg. 2. Is taken from the *Chomer* or *Corus*, which all agree to be the same, and to contain 10 *Ephas*, and is made the Rule of *Epha*, by *Ezekiel* 45. 11. regulating prudently the less by the greater. Now *Josephus*, lib. 15. cap. 11. saith expressly, That *cap. 12.*
 ὁ νόμος δύναται μετρίων Αἴμων δέκα :
 Wherefore he hereby intimates, that *Epha*, the tenth part of *Corus*, was

equal to the *Medimnus Atticus*. The Content hereof we must first find in Roman Measure, to which the ancient Greeks and Romans have reduced it; and then we must reduce the Roman Measure, by help of *Vespasian's* Standard *Congius*, still remaining at Rome, to our English Standards: and so we shall see how far *Josephus* his Estimate of the *Epha*, agrees with, or differs from that which I have proposed.

But I must premise, even to the first Reduction, that two things are agreed among the ancient Greek Writers:

1. That *Medimnus Atticus* was equal to 48 *Chanices*. So say *Pollux*, *Harporocra* *Aarpocraton*, *Galen*, &c.

non.

2. That one *Chanix* was equal to three *Cotyla*. So *Pollux* in two places, in words at length, not subject to so much corruption, through mistake, as Characters are; and *Cleopatra*, and others.

Hence the first Reduction to Roman Measures is thus made; every *Cotyla* is equal to half the Roman *Sextarius*, and consequently 12 *Cotyla* to the

Paul
4
or 5

the Roman Congius. So Galen, and the Author of the *Hippiatric* Weights and Measures, *Dioscorides*, and others, to be seen in the Treatises set at the beginning of *Stephanus* his Appendix to his *Thesaurus*. Herewith agrees what the same Authors and *Cleopatra* affirm, that 4 *Chenices* are equal to the Congius, or to 12 *Cotyla*. Hence it follows, *Medimnus Atticus* being equal to 48 *Chenices*, must be equal to 12 *Congii Romani*; for 48 divided by 4, which is the number of *Chenices* in a Congius, quotes 12. *wh makes 120^t; or an*

For the second Reduction, whereby the Roman Congius, and the Greek *Medimnus*, *Chenix*, and *Cotyla*, may be brought into solid Inches of English Measure, and so compared with our Measures of Capacity, I offer this Expedient. It is agreed, and the Inscription on the Congius of *Vespasian*, witnesseth it, that Measure contained just 10 Roman Pounds of Water, or Wine. Each Roman Pound was 12 Roman Ounces; each Roman Ounce hath been found, by *Greaves* and others, to answer exactly to 438 Grains of our Troy Weight: Where-

*Amphora p
Kellp. Att.
Vibalspondy
makes a
modius
120^t at
makes 4
modius 26^t
4 3/4
now by
6^t 3/4
then that of
120^t of
diminus 200^t.*

*438 gr. 3
12 3
876
4380*

*But an Attick 3 or 4 drams
is reckoned after rate of 528 gr
or 536. p. 112.*

*fore 5256 gr. to
v. p. 112.*

fore it wants 42 Grains of our *Troy* Ounce. And just so many Grains as *Dr. Chamberlain* in the State of *England* affirms, doth our *Averdupoise* Ounce fall short of the *Troy* Ounce, which is 480 Grains. Hence I conclude, that our *Averdupoise* Ounce, is the same Weight with the old *Roman* Ounce, which hath continued to be used, both in *Rome*, and here in *England* to this day, from the eldest Times. And we must consider, that the name *Averdupoise*, which signifies Weighty, was not at first given to this Ounce, but to the Pound, consisting of sixteen or eighteen such Ounces; which therefore was much more weighty than the usual *Roman* Pound, which had but twelve such Ounces: ~~Roman~~ which Pound is not used among us; although the Ounce, as part of a weightier Pound, be still retain'd.

Sir *Jonas More* hath calculated a Table (founded in Experiments, concerning the Weight of any known Number of solid Inches of Water, made by *Dr. Wibberd* and others,; whereby we may turn any given Ounces *Averdupoise* of Water, into solid

Mea-

Weights and Measures.

75

Measure, expressed in Inches and Decimals thereof; which because it is short and useful for my purpose, I will transcribe.

By this 12.5 or 12.500 is equal to 20, 70672 inches of water. half a pound or 6.3 to 10.35336.

Ounces.	1	1.72556	Inches Solid and Decimals.	<i>2 7 3 (very near) is answered by 12 inches</i>
	2	3.45112		
	3	5.17668		
	4	6.90224		
	5	8.62780		
	6	10.35336		
	7	12.07892		
	8	13.80448		
	9	15.53004		

For an Example to shew the use of this Table; Let us take the 10 Pounds of Water that fill the Roman *Congius*; and because each Pound is 12 Ounces *Averdupoise*, call them 120 Ounces; *the 120 pds* the highest Figure signifies 100 Ounces. Wherefore take out of the Table the Number answering 1; and because of the two Cyphers which make it an hundred, remove the Separatrix two places further; thus writing 172.556 172.556 . So also for the 20, remove 34.511 the 207.067

the Separatrix one place thus, ^{from p. 75 - 172 556} 34.511

207.067

This Sum gives the solid Inches of Water that fill the Capacity of *Congius Romanus*; and shew it to be less than our Wine-Gallon of 231 Inches, by almost 24 solid Inches. So *Cotyla* containing 10 Ounces of Water, is found in solid Inches, 17.25; and *Chanix* containing 30 Ounces, must be in solid Inches 51.76. So, lastly, to determine the *Medimnus* by the solid Inches of Water that it contains, multiply the Content of *Congius* by 12, the Product is *Medimnus*,

note y^t 134
3 according
to y^e table
p. 75 make
y^e wine Gall
of 231 Inches
comparing y^e
with what y^e
said of y^e F
- per which the
1000 2 and
1726 Inches
134 should
make how much
more note
or thus

207.06 (7th cast away)

207.06

12 12

414 . 12
2070 . 8
2484 . 72

41212
20706
2484.72

The *Medimnus* thus found, when compared with our proposed *Epha*, proves bigger than it by 737 Inches, or above three Gallons Wine-measure. This shews that although I have exceeded the common estimate of *Epha*, which makes it the Cube of the Roman

man Foot, on very weak grounds, yet I have not gone so far as *Josephus*.

Nor can I recede from the Reason I have alledged for *Josephus* his affirmation, but shall answer his Authority, by saying ;

1. That I conceive he did not intend to assert a precise Mathematical Equality between *Epha* and *Medimnus* ; but to express the content of a Jewish Measure, as an Historian, somewhat near the truth, by comparing it to this most famous approaching Measure, known among the Greeks, in whose language he wrote.

2. That an *Epha* heaped up, will answer very well to a *Medimnus* not heaped : this seems a sufficient conciliation, that he respected an *Epha* cumulated ; my number respects only an *Epha* strickled (as the Country-men speak) which is most certain and constant ; because the Breadth or narrowness of the Measure, will alter the heaping very much.

To this head I shall adjoin another approach to *Epha*, by help of the Greek *Chenix*, which is founded on a probable emendation of *Hesychius*,
which

which I crave leave to propose, because the place is certainly corrupted, and I have not met with any attempt to mend it. Thus it is now printed; *οὐκ ἐστὶν μέτρον Αἰγύπτου πεσσαρχοῖνικον.* That it is an Egyptian Measure, is truly and judiciously affirmed; but that it contained but four *Chenices*, is far from credible, for that would make it all one with the *χῆς*, or *Congius*, which it far exceeded by the acknowledgment of all.

Therefore I have thought it probable, that *Hesychius* did write it, either in Characters thus, ΔΔΔΙΙΙ χοῖνικον, as *Herodian* informs us the Greeks anciently wrote 34, putting three ΔΕΛΤΑ's for 30, because each Δ stood for δεκα, or Ten, being the first Letter of that word, and each Ι for single Units. And some Transcribers afterward being ignorant hereof, did take Δ to signify 4, as in later Times it doth, and the Ι's the same; and to avoid Tautology, wrote πεσσαρχοῖνικον. Certain it is, that there should be, and probably was, either a Word or Character signifying 30 (either ΔΔΔ or λ) placed before πεσσαρχ, to make it fit to

to signify the number of *Chenixes* in an *Epha*; which word, or Character, is now lost. And that no Number is so fit (as thirty) to be added, will appear by the coincidence of 34 *Chenixes* with the former Calculation from the Cubit. Thus *Chenix*--51,7 multiplied into 34, produceth 1757,8, and this differs from my assertion but the third part of a Pint, which is as little as can be expected in so big a Measure.

However, I trust not to this Emendation alone; but if a better can be offered, shall thankfully admit it: Wherefore I will offer another approach to the finding a *Corus*, and *Epha*, by help of a Roman Measure taken out of an ancient Anonymus Latin Author, cited by *Salmasius*, in his Epistle to *Walaus*, called by him, *Auctor vetus adjectus Scriptoris Rei Agrimensoriae*. He affirmeth, that *duo Cori Culleum reddunt*. Hence I would draw an Argument (which it appears not that the Authors from whom I take this Testimony, did think of) to determine an approach to the Capacity of *Epha*.

For

For if the Roman *Culeus* (as it's oftner written with single *l*) be equal or near to two *Cori*, it must be so to 20 *Ephas*. Now the Capacity of *Culeus* is intimated, both by *Pliny*, lib. 14. cap. 4. and by *Columella*, lib. 3.

Amphora - cap. 3. to be twenty *Amphoræ*, or *Quadrantals*, each of which is known from *Sextus Pompeius* his *Plebiscitum Siliorum*, to contain 80 Roman Pounds of Water, or 8 *Congii*. So by this Argument the Roman *Amphora*, and Jewish *Epha*, will be made equal, or near each other; for Mathematical Exactness is not to be hoped for in such Authors.

The Roman *Amphora* did contain 1656 solid Inches, and near half an Inch more; as appears by multiplying the Content of *Congius* 207.06 by 8. And this is indeed bigger than the Cube of the Roman Foot on *Cossutius* his Monument, by above three Pints of our Wine-measure, as *Greaves* attests he experimented, pag. 35. of his Learned Treatise on the Roman Foot. But still this 1656, is less than our Number 1747, deduced from the Egyptian Standard; and more below the

1656

1747

2484 72

the Content of *Medimnus* 2484, which *Josephus* thought near enough. Wherefore since our number falleth above the *Amphora*, which this Author must make equal to *Epha*, and below the *Medimnus*, which *Josephus* points at, as equal thereto; I hope, that being in a mean, and keeping to a publick Standard, I may have determined more exactly than either of them. And both their Testimonies will agree to assert, that I am not very far from the Truth, each of them coming nearer to me, than they come to each other. This is the sum of my second Argument.

My third Argument shall be, an attempt to prove my determination of *Epha* to be true, from Evidence, that the best Determinations which the Ancients have given us of the Capacity of *Seah*, comes near to the third part of the measuring Number which I have assigned; this being agreed by all, that *Seah* was the third of *Epha*.

And here I shall first consider, what *Suidas* affirms; referring to a Number
G of

of Roman *Sextarii*, which we know by the Standard yet remaining: and then supply what is confessedly deficient in him; by the elder Testimonies of *Josephus*, *Epiphanius*, and *Hierom*.

Suidas, in Σάτον, which is the Hebrew *Seah*, altered after the Greek fashion, affirms it to be the Roman *Modius*, filled so as to run over its brinks; and that it holds in Liquids 15 Sextaries, or 25 Pounds. The weight in Water annex'd, secures us he speaks of the Roman, not the Attick Sextary. Now fifteen Roman Sextaries are equal to two Congii and an half; which in solid Inch-Measure of Water, 517.66, being 300 Ounces in Weight. But this is less than the third part of our *Epha*, that being 582: So there wants above a Quart of our Wine-Measure. And *Suidas* implicitly confesseth his Measure too little, by saying it must be *ὑπερ-ᾠς*. *Agri πλεονέκτου*, heaped up so as to run over. This Heap might easily supply the Quart wanting in the Account in Water, which will not be heaped, and which indeed is less than com-

I think if
Atticks had
no ppe for
tortu, ex-
cept you
had colla
post for an.
ye popla
- by was tak-
- sh from &
modern way
& was ypp
& Chani-
col. Agri
cola. p. 61
But not if
find up 3
515 so colla
popla
p. 48.

commonly is allowed to the *Modius*, it being usually reckoned sixteen Sextaries, and that would bring the Capacity of *Seah* to agree with mine within a Pint.

However, to inform us that the *Modius* was less than *Seah*, *Epiphanius* tells us, that it was equal to *Modius*, and $\frac{1}{2}$. And *Josephus*, lib. 9. c. 2. "and *Hierom*,[†] on *Matth.* 13. 33." ^{mishi} p 240. D. say, it was an Italian *Modius* and an half. [†] vol. 6. p. 26. I know that the *Modius* is a disputed Measure; therefore to avoid that dispute, I counted by Sextaries, which being $\frac{1}{2}$ of *Congius*, are indisputable. And if the least Capacity of *Modius* be taken, yet 1 and an half will somewhat exceed the Capacity I have assigned. Therefore the *Seah* which my Number requires, falls between a confest Defect in *Suidas*, and an Excess in *Hierom* and *Josephus*, yet not far from either of them, and therefore is probable, being nearer to both Extrems in those Authors, than they are to each other.

My fourth Argument is from the agreement of this number of solid Inches, with the content of 432 Hens Eggs, whereby the Jewish Doctors frequently determine the Capacity of *Epha*; as may be seen in *Buxtorf's Lexicon*, in \aleph in *Arias Montanus*, *Tubal-Cain*, &c. Now if we divide my Number 1747, by 432, it will quote 4.04: which shews, that little above four solid Inches must be in an Egg, that 432 of them may make this quantity. And Experience attests, that the larger sort of Hen Eggs, which yet are common, will contain four solid Inches of Water, or two Ounces and a third: and Measures when taken from Nature, are rather taken from the bigger Instances, than the less, as the Greek Foot from *Hercules* his Foot; and the Cubit from the Elbow to the Fingers end of a tall Man.

This experimental way I chuse as more easy, than the Geometrical reduction of an Egg to a Sphæroid, or two *Conoides*, which few would understand.

4 Solid Inches
con. lo. 2 $\frac{1}{3}$
 $\frac{1}{3}$

derstand. I might also shew, that as some, both Jews and Christians, have assigned less Capacity to the measuring-Egg than I; so others, particularly *Capellus*, have given more: And that this Capacity may therefore be called a Mean Capacity, although it come near to the largest sort of Hen Eggs; but it is sufficient to have pointed at these things.

The Fruits of this long, because difficult investigation of the *Epha*, will be gathered in the easy determination of the other Measures of Capacity, whose Proportions thereunto are generally agreed on. For besides a Bath, which is equal to it, it will follow, that

G 3

Corus,

v. p. 137. where the proportions are a little differ

	Sol. Inches.	Wine Gall.	P.	Inch.
Corus or Chomer, viz. 10 Ephas	174.77	75	5	7
Bath or Ephas. page 63. 8.	174.77	7	4	15.2
Seah the third of Ephas	58.25	2	4	3
Hin the sixth	291.25	1	2	15
Hebber the tenth	174.77	0	6	05
Cab the eighteenth	97.08	0	3	10
Log the seventy-second	24.27	0	0	24.2
				In

In this Reduction to our Measures, I have used the Wine-Gallon, because more generally known and used among us; notwithstanding the Corn-Gallon is the Statute-Measure. And because the *Epha* and *Homer* after this Reduction fall out to answer very near known Measures; *Homer* to three Quarts; *Epha* seven Gallons, a Pottle and half a Pint. Also in the *Corus* I have express'd the last seven solid Inches, although in *Epha*, its tenth part, I often omit the seven Tenths of a solid Inch as inconsiderable; because it grows considerable when it's multiplied by Ten.

of 231. Inches

of 272. Inches

To remove the Objection which lies open against these Measures, that thereby an *Homer* becomes too great a quantity of *Manna* to be allow'd, as it was by God to every Man, for his sustenance in the Wilderness; let these things be considered.

1. That Divine Bounty is concerned to proportion to each Man, now travelling, so much, that he may rather leave somewhat, than lack.

2. That *Manna* being like Coriander-seed, of a globular figure, when it

was in the *Homer*, must necessarily leave many empty Spaces, between every three or four *Spheres*, which had no Food in them; and these Vacuities added together, may reasonably be estimated about a third part of the Vessel's Capacity. For the solidity of a Cube, many of which will fill up a space without any empty Interstices, is almost as big again, as a Sphere, whose Diameter is equal to the Cube's side; the Geometricians say, as 1 to $523\frac{1}{2}$:

3. It being light food, must needs be inwardly porous, and of a spongy contexture of Parts.

4. It would probably waste somewhat in dressing by the Fire, as it melted and wasted when the Sun grew hot. By these Reasons the three Quarts at first measuring will be reduced to to about three Pints of an oily liquid substance, which will not be too much for a Traveller, that needs eat thrice a day.

The *Homer* being thus freed from an obvious Objection, before I leave it, I think fit not only to observe the Antiquity of the Numeration by Tens in these Measures, *Corus* holding 10 E-

phas,

phas, *Epha* 10 *Homers*: but also to add, that I have observed, that the Athenian Measure, *Cotyla*, (which, as I have intimated, held 10 Ounces of Water, and so was half a Roman *Sex-tarius*) must needs therefore be the tenth part of an *Homer*, as I before shewed it to be the twelfth part of the Roman *Congius*. And we shall less wonder that *Athens* carried on this Subdecuple Proportion in one of their Measures; if we consider that *Athens* was a Colony both from *Sais* in *Egypt*, and from the Phœnicians, as the best Antiquaries and Geographers agree.

By help of this Observation, we may note, that this *Cotyla* is a common Measure, to most (if not all) the Measures of Capacity, used among the Jews, with other Eastern People, and these Western famous Nations, the Greeks and Romans: and so may serve to shew the Harmony between them, and their Reduction to such an ancient Standard as the *Congius* of *Vespasian*, which is yet kept at *Rome*; and may suggest a probability that the common Original of them (as also the rise of
Man-

Mankind, and of the most necessary Learning) was from the East. Ten *Cotylas* make an *Homer*, hence the Jewish Measures may all be determined: two of them made a Sextary; hence the *Congius*, and other Roman Measures, three of them made a *Chenix*; hence the *Medimnus*, and other Greek Measures. The word also is received at *Rome*, as well as at *Athens*; and I find, by Dr. *Castle's Lexicon*, that it's used by the Syriac and Arabic Writers of the East, although not found in the Hebrew Bible, wherein I meet not with any less measure than the *Log*. However, because its Root, and other words akin to it, are found in the Hebrew, and other Eastern Languages, but no Root nor Kindred in the Western: I rather believe that its Original was in the East, and the Greeks received it thence; than that the Eastern Nations received it from the Greeks.

By this Analogy between Eastern and Greek Measures, I am induced here to mention the *Metretes*, which *St. John* mentions, *chap. 2. 6.* which we translate a Firkin, which is eight or
nine

nine Gallons Ale-measure : at which rate the Water which Christ made Wine, will rise to about 100 Gallons ; which may well seem too much for our Saviour, the great Teacher and Pattern of Temperance, miraculously to provide for the Guests at a Wedding, after they had well drank before.

*Five water potts
48 or 56 gallos
if they contain
but one pottle
But if well foy
2 or 3 pottles
therefore 96 or
112 Gallons*

To remove this Difficulty, our Critics have said many things, which I need not repeat. But I will add one Notion about this *Metretes*, which I have not found amongst our Commentators, which if it be admitted, will altogether prevent the Objection. I find in *Cleopatra's* Discourse about Weights and Measures, which with others of that Subject, is in the Appendix to *Steven's Thesaurus*, that *Metretes*, among the Syrians, consists of six *Sextaries*. Now it's known that the Greeks and Romans too, did often so extend the Name of *Syrians*, as to comprehend the Jews, especially those of *Galilee*, that just toucht *Syria*, strictly called.

Wherefore I conceive *St. John*, speaking of this Miracle done in *Galilee*
on

rather about
10 gallons &
pints or 16
gallons.

on the Syrian Coast, calls that *Measures*, which the Syrians called so, and that is the Roman *Congius*, consisting of six Sextaries. Now I have shewed already, that this is near a Pint less than our Wine Gallon. And so the Miracle will produce about ten Gallons and an half of our English Measure; which if the Guests were of any considerable number, might easily be drank without danger of Intemperance, especially since Marriage-Entertainments did use to last for many days, *Judges 14. 12.*

v. Vallapond
p. 450.

I shall conclude this Discourse with the consideration of *Solomon's Brazen Sea*, that capacious Vessel for Water required in the Temple-Service. Its Height is five Cubits; its Diameter, called Breadth, ten; its Figure affirmed to be round: but it's not determined in the Scripture, whether this round Figure were an Hemisphere or a Cylinder, equally wide at the bottom and the top, or a decurted Cone that was wider at the bottom than the top, where its wideness is expressed; or whether some other irregular

regular Figure of a protuberant Belly. Yet it's ordinarily represented to us in Cuts as an Hemisphere.

But the main Difficulty ariseth from the Capacity of it, which in 1 *Kings* 7. 26. is expressed 2000 Baths; and yet in 2 *Chron.* 4. 5. it is affirmed to hold 3000 Baths. The Hebrew Copies, and the ancientest Translations, constantly delivering this different Account; it's not prudent to affirm either place to have been corrupted by Error of Transcribers.

Therefore I think *Grotius* hath well suggested, that in the first place ordinarily, when it was not filled up, it had 2000 Baths of Water in it; but, secondly, upon extraordinary Occasions, when more was requisite, as at the great Festivals, it could, and did hold that greater number of Baths. This answer gives a good general Reason of a different Content ascribed to this Vessel.

But when we come to express the Cubits of its Dimensions in determinate Numbers of Inches, and after Multiplications suited to the Figure, divide the Product by the solid Inches
of

*da Sajalox.
v. Villetpondi
p 450.*

of the Bath, or *Epha*, we shall find Difficulties to arise, which this Answer will not remove.

For instance; Let us suppose the Figure of this Sea to be Cylindrical, because I shall soon shew this to be more likely than that of an Hemisphere. The Diameter of the Base of this Cylinder being ten Cubits, must, according to our determination of the Cubit, be in Inch-measure 218,88; and its Height five Cubits, is in Inches 109,44. To find the Solidity or Content of this Cylinder, we must, first, find the *Area* of its Base, by this Analogy taught by *Archimedes*. As 14 is to 11; so is the Square of its Diameter, *viz.* 47908,4544, to the *Area* of its Base 37642,1357. Then we must multiply the *Area* by the Height; the Product of which Multiplication is the Cylinder's Content, *viz.* 4119579,44. Lastly, This divided by the solid Inches of *Epha*, 1747, will quote 2358,08; the number of *Ephas* contained in that Cylinder. Hence it appears, that it will contain above 2000 *Ephas*, or Baths, which is the Number expressed in the

the *Kings*; yet not 3000 as the *Chronicles* saith, but there want 642 Baths almost.

Hence we may learn, that since a Cylinder of these Dimensions is somewhat too little to hold the 3000 Baths; therefore an Hemisphere, which is commonly offered to us of such Height and Diameter, will be much more too little. For *Archimedes* assures us, that it is but two thirds of such a Cylinder, and therefore will hold but two thirds of its number of *Ephas*, viz. 1572, and so will want 428 Baths of the 2000, or lesser Number.

Wherefore we must conclude, that either our Cubits, and *Ephas*, one or both, are too big; or that this Figure is to be rejected as too little. But because we have given much proof of the truth of our Cubit and *Epha*, and no Proof is given of this Hemispherical Figure, let that rather be rejected: but because our Cylinder doth not only answer the less number of Baths, but gives us above a third part of the superadded thousand, which is in the *Chronicles*, I dare not reject it. For I acknowledg that it's possible,
that

that the Author of the *Chronicles* adding 1000 to those in the *Kings*, might only by that round Number intimate, that it held many hundreds of Baths, upon extraordinary Occasions, above those 2000 which the Author of the *Kings* had expressed, as ordinarily contained in it.

And indeed it's certain, that he doth not in this matter of the Sea, speak according to Geometrical accurateness: for when he had said that 10 Cubits were its Breadth or Diameter; he adds, that 30 Cubits would compass it round: whereas Geometry assures us, that above 31 Cubits are requisite to make the *Perimeter* to a Diameter of 10. And yet it's ordinarily allow'd in Discourse, that pretends not to Mathematical Rigour, to say, that thrice the Diameter is the Circumference; so may this Sacred Historian say, in a round Number, that the Sea held 3000 Baths, when in strictness its Content was not quite so much, but yet considerably above 2000.

Those that are not satisfied herewith, may safely assert, that this Sea
was

was either so much wider at the Bottom, or so much swelled in the Belly, that it would contain 642 Baths more than the Cylandric Figure will yield; because there is nothing contrary hereunto in the History. And it will be more reasonable to adjust the Figure which the History determines not, to the Capacity which it doth express, than to reject the Measures asserted by so much proof, because they do not perfectly agree with a Figure which is pitch'd upon only by conjecture.

Since I came to this resolution of the Difficulty now before us, I have been confirmed in my Opinion, by reading in Dr. *Lightfoot's* prospect of the Temple, *Cap. 27. Sect. 3.* that both the *Talmudists*, and the *Rabbins*, have acknowledged that 3000 Baths cannot be contained within the Dimensions of ten Cubits wideness, and five height assigned by Scripture, unless the Figure of this Molten Sea be affirmed to be wider than that of a Cylinder below the Brims. Thus far their Assertion agrees with my Accounts, and assures me, that their Notions, both of the Cubit's Length, and

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of

of the *Ephas* Capacity, were not greatly different from mine, because they own with me, that this number of *Ephas* is indeed somewhat too great for the Capacity of a Cylinder, the Diameter of whose Base is ten, and its Height five Cubits; but that what's wanting in this Figure, may be well supplied, by widening it towards the bottom, which I also have owned; We differ only in the manner of widening it sufficiently below the Brim. For the *Talmudists* assign this way, That it was made square at the bottom, each side ten Cubits, and rose in this Figure of a *Parallellipedon* (as the Geometricians call it) up three Cubits high, but the other two Cubits of its height were a Cylinder, whose Base had ten Cubits in its Diameter. But surely they did only conjecture that this Figure would enlarge it sufficiently, and never calculated its Capacity carefully. For upon a strict calculation of the Content of this their compounded Figure, I find that it will be too little by above 250 Baths. And yet the Cubit which I have assigned and calculated by, is longer than

Dr.

Dr. *Lightfoot's* Cubit, and therefore will make the Sea sufficient to hold more than his: and the Bath I have assigned, is less than his, and therefore more of them will be contained within the given Dimensions; and so both my Measures are fitted to remove the Difficulty; whereas by his Measures, bound to the *Talmudist's* Figure, it's made insuperable, and involves an impossibility. But adhering to my Measures, I find that a *Parallelipedon*, the side of whose Square at bottom is ten Cubits, and its Height full five Cubits, will contain 3001 Baths, and a little more: whence it's plain, that if two Cubits of its Height had been Cylindrical, it must needs hold less by a considerable quantity, the Angles being taken away, which held much. Yet because in this *Parallelipedon* we have above a Bath more than we need, we may take off a little of the Corners near the top, and there make it Cylindric, that so it may both answer the Scripture's Historical Dimensions of about thirty Cubits, compassing it round at the top, and in some Measure agree with

the *Talmudist's* Tradition of a little Cylinder uppermost, though it must be much less in its Height than they affirm. For it's certain, by the Principles of Geometry and Arithmetick, that if 3000 Baths of the Measure which I have assigned, be comprehended in a Figure, compounded of Parallellipedon and Cylinder, whose Diameter is but ten Cubits, and their Height taken together but five;

That, first, the *Parallellipedon* must have its side in Inch-measure 218,88: The Square whereof we have shewn to be, 47908,4544; and the Height of it must be, in Inch-measure, 109,24, which is five Cubits wanting less than a quarter of an Inch. So the Content of this part of the Molten Sea, will be 5233519,558.

Then, secondly; the Cylinder's Base having its Diameter 218,88, the *Area* thereof will be 37642,1357, and its Height must be but .2, two Tenths of an Inch; so will the Content of that short Cylinder be, 7528,427: Wherefore the Contents of both parts of this Figure being added together, will be 5241047,985. This Sum being
divided

divided by the solid Inches of the Bath 1747, will give in the Quote 3000, with an inconsiderable Fraction overplus, which I allow'd, because I would not affect overmuch preciseness, neither would I take too little. By this Process I have both demonstrated the Defect of the *Talmudists* Figure, and also shew'd how it may be mended, so as to serve the End for which it was intended; *Rectum enim est index sui & obliqui*. And now I shall leave it to the Reader's choice, either to take the Figure with a protuberant Belly, which I before proposed, which seems more Ornamental, being like that of the Cisterns used in Noble-mens Dining-rooms; or to take the Talmudical Figure with this Emendation which I have offered. And I have thought fit to examine this Talmudical Notion the more diligently, both because the learned Dr. *Lightfoot* in the place fore-quoted doth (according to his usual modesty) desire it might be considered; and because it seemed to me proper to oppose this Doctrine of the *Talmudists*, con-

cerning the Figure of this Molten Sea, to the Conjecture of *Josephus*, who intimates it to have been Hemispherical, (which Geometry demonstrates to be insufficient for the reception of so many Baths; and it's certain he had never seen it, for it was broken and carried away at the Captivity, *Jer.* 52. 17, &c.) and their Authority concerning things Sacred, weigh much more among the Jews, than any Opinion of his.

CHAP.

C H A P. IV.

Of Shekel, and other Weights and Coins thence determined.

I Shall not distinguish between *Shekel* considered as a Weight, and the same as a Coin, having no concern to enquire about the Letters and Impress that it bears; but only to express its Weight, in Weight known among us; whence its Value in our Coin will easily be deduced. I conceive that it was just of the Weight of half an ounce *Averdupoise*, now and anciently used here in *England*; or it weighed 219 Grains used in our *Troy-Weight*, and so wanted 21 Grains of the half Ounce *Troy*.

This is proved;

1. By many *Shekels* still remaining that differ not sensibly from this Weight, which may reasonably be thought to have been tried by the Jew-

ish Standards, when they were coined. Of these *Villalpandus* reckons up many; and *Greaves* two; one in the Library of King *Charles* the First, of Blessed Memory, weighed by Arch-bishop *Usher*; and another in Mr. *Selden's*, weighed by himself, as he witnesseth, in his learned Treatise of the Roman *Denarius*, p. 76, &c.

I have also seen and weighed two *Shekels* with Samaritan inscriptions on them (which although I had not opportunity to weigh them to a Grain) yet I do testify they weighed within a very few Grains, as is above expressed. Nor can I find any sufficient reason to reject these as counterfeit; and if any will believe them to be such, yet it must be acknowledged, that they are made so as to agree in Weight with the Testimonies of the Ancients, which is sufficient to our purpose, because their value in our Coin may certainly be deduced thence. For since it's known that now, by the Laws of our Mint, 62 pence are coined out of every Troy Ounce; it will follow that 2 s. 4 d. and a farthings worth of Silver, with 3 Cen-

Centesimals of a Penny over, must be contained in 219 Grains, which is the Shekel's weight. By this Analogy; as 480 s. are to 62 d. so 219 s. are to d. 28, 28 Decimals of a Penny, which make 1 Farthing, and near the 8th part of a Farthing.

"219 grains &
480 grains
not shillings
an 3 Hadley
making about
56.06 x 4 of a farthing

or 56, 5075.

My second Argument is taken from Testimony of Antiquity, thus: The *Shekel* was equal to the Roman half Ounce, but that was 219 Grains of our *Troy* Weight: therefore so was the *Shekel*. The *Major* is affirmed by *Jerom* on the 4th Chap. of *Ezechiel*, to contain four Drachms of the Latin Ounce. The Greek Author of *Farrier-Weights* saith, $\Sigma\iota\kappa\lambda\iota\omicron\nu\ \epsilon\chi\epsilon\iota\ \delta\gamma\mu\iota\alpha\varsigma$, S: which is the Mark for $\eta\mu\omicron\nu$, or *Semissis*: where $\Sigma\iota\kappa\lambda\iota\omicron\nu$ plainly signifies the *Shekel*, and is falsely rendred in *Stephanus* by *Siciliquus*, which is agreed to be but a quarter of an Ounce, whereas this is affirmed to be half, by the Author.

S. 10
and 8 make a
Latin ounce

So also *Stater*, which is known to be the same with the *Shekel*, is twice affirmed by *Cleopatra*, to be four Drachms, which is half an Ounce.

To

To these may be added the clear Testimony of *Moses Nebemanni Gerundensis*, related in *Arias Montanus*; wherein he owns himself to have formerly doubted of this which was *Solomon Jarchi's* Judgment; but to have been convinced and satisfied by weighing a *Shekel* with Samaritan Inscription; which was just half an Ounce. Many more Testimonies of Rabbins might be added, but I think them not necessary.

Only I will add a Testimony of *Anton. Augustinus*, concerning two fair Carthaginian Coins, weighd by him, which each of them answered to four Drachms, or rather little more. Now it's known the *Carthaginians* were a *Tyrian-Colony*, and that the Jewish Coins agreed in Weight with those of *Tyre*, the *Talmudists* affirm. Hence the *Major* seems abundantly evident. The *Minor* is vouched by *Greaves*, who diligently compared and tried the Roman Standard Ounce, with the Ounce and Grains of our Standard. And *Villalpandus*, with others, have from the Weight of Water in the *Congius* yet remaining, proved,
that

that the Ancient and Modern Roman Ounce, is exactly the same unaltered by Time.

From hence I collect, or conclude also, that our English *Averdupoise* Ounce also, being (as I before shewed) the same with the Roman Ounce, when they are both reduced to Grains of *Troy-Weight*; was probably introduced into our Kingdom by the Romans, when they gave Laws, and planted Colonies here, and hath thence continued unchanged to this day; which is not commonly observed, because we use the *Averdupoise* Weight only about heavier Commodities; not in weighing Silver and Gold, and therefore do not divide that Ounce into Grains; as we do the *Troy-Ounce*, which I suppose was introduced by the Normans, because it take its name from a French Town *Troyes* in *Campaigne*. I may add also, that it's probable hence, that both the *Roman* Ounce, and our *Averdupoise* Ounce, had their more remote Original from the Eastern *Shekel* doubled: and evidence may be given, that such Weights
and

and Coins, consisting of two *Shekels*, were sometimes used in the East by the name of *Selaks*; but I must not digress farther.

A third Argument may be taken from the constant Tradition of the Jews, that their *Shekel* weighed 320 common Barly-Corns, in *Schalſheleth*: but these Corns ordinarily answer 219 Grains of our Weight; therefore, &c. Nevertheless it must be acknowledged, that there is no perfect constancy in this matter of Experiment, which I have made with success; yet variety of a few Grains will frequently fall out. But because Nature alters not much in the Weight of ordinary Barley, this may be accepted as a Proof, that we have assigned *Shekels* Weight, at least very near to exactness: but perfect accuracy is rather to be sought in the former Arguments, which bear upon the Jewish and Roman Standards; than on this which resolves it self into Nature's Constancy, to produce Grain near alike in different Times and Places; but yet doth
reserve

reserve to her self a liberty of making some variety.

Such was the *Shekel* of the Sanctuary, or agreeable to the Standards of Weights and Measures there kept. Another *Shekel* half so heavy, is contended for by some Modern Jews and Christians: I confess I am not satisfied that there was any such *Shekel*. A piece of that Weight I acknowledg, but constantly it bears the Inscription of half a *Shekel*, called a *Bekah*, *Exod.* 38. 26. However, it is sufficient that my care to determine the Sanctuary *Shekel*, doth fully determine also the Weight of its half, which must be 109 Grains and a half. They who are willing to see Arguments on both sides, may find them in *Hottinger de Cippis*, p. 110, &c. to whose Judgment I have nothing material to add. Also the near approach of the Roman *Denarius*, and of the Attic *Drachma*, to the fourth part of the *Shekel*, together with their difference from each other, and from the precise quarter of a *Shekel*, is well stated by *Greaves*; distinguishing the intrinsic Value

Value rising from meer Weight, and the extrinsick rising from the Stamp, and Laws peculiar to several Kingdoms, in his Treatise fore-quoted, to which I therefore refer the Reader; my Business being only to give the true Weight and Value of *Shekel* in our English Coin; and not to compare it with those Foreign Coins for which it was sometimes exchanged by the *Trapezites*, who made considerable advantage by the Trade.

The Consequents of our thus stating the *Shekel*, are these.

a *Shekel*
p 108. gr 219.

1. Hereby all its Parts, and the lesser Weights or Coins, in known proportion to it, are determined: particularly hence it follows, that the *Bekah*, or half *Shekel*, is in Grains Troy 109.5. The quarter thereof, called *Zyza* by the *Talmudists*, is Gr. 54.75. Its twentieth part, which is called *Gerah*, *Exod.* 30.13. and is understood to be the same with *Agu-rah*, *1 Sam.* 2. 36. by *Rab. Solomon* and *David*, though we translate it indefinitely a piece of Silver, must be Gr. 10.95: which wanting but the

the twentieth part of a Grain of eleven Grains, may pass for just so many. And accordingly is well translated in the *Septuagint*, by the Greek *ὀβολός*: for there are *Attic Oboli* still remaining of this Weight mentioned by *Greaves*, which give another Argument to evince, that the *Shekel's* Weight hath been rightly stated by us, because its twentieth part, the *Gerah*, or *ὀβολός*, is found by the remaining Coins to be right.

And it's highly probable, that the Athenians being a Colony, partly from *Egypt* under *Cecrops*, partly from *Phenicia* under *Cadmus*; brought this Egyptian and Phœnician little Weight or Mony with them. I find also in *Cleopatra*, that the *Obolus Atticus* is called the *Drachma Ægyptiaca*, and is there affirmed to be the sixth part of the *Attic Drachma*; and consequently hence we may learn to reduce to ours most other Greek Weights, whose proportion to the Drachm is given us in *Galen*, *Dioscorides*, and several other Greek Writers.

The

multiply 65 gr The Attic Drachm by this reckoning, must be in our Troy Weight 66 Grains; the Learned Greaves hath stated it 67. The difference of one Grain in so many, is so small, as not to be worth contending about; but I count my Reckoning sufficiently confirmed by its near approach to his.

But to return to our Gerah, or Obolus. The determination thereof is useful, because it's proved by Arias Montanus, Waser and Hottinger, out of the Rabbins and Talmudists, that this is of the same Weight and Value with the ancient Coin called Kesbitah, sometimes translated a Lamb, probably because either of its Impress, or its old Value, being when Mony was rare, sufficient to buy a Lamb. This is mentioned Gen. 33. 19. Jos. 24. 32. Job 42. 11. but is expressed by St. Stephen, Acts 7. 16. to be a piece of Mony.

To this Head also belongs the Investigation of the Darchmon or Adarcon, both which words, by the Septuagint, are translated $\delta\epsilon\alpha\chi\mu\acute{o}\nu$, as

multiply 65 gr
by a Troy Drachm
wt or reckoning
in y Attic
mina f.
6600 gr.

v. p. 73 where
a Roman pd y
stated at 5296
grains & yield
but 54275
hgt dr. 96

a Troy pound
5760 divided by
96 yields sh
each from
60 gr. 3

5760 gr. our
mint whole.
480 grains
in a Troy 3
divided by
8 yield 60
gr. or 7
dgr.

but divided
as it ought
by 7 1/2
makes 60 3/4

as both signifying the same Coin. They are mentioned 1 Chron. 29. 7. Ezra 2. 69. Nehem. 7. 69, 70. Our Learned Brerewood hath suggested, that the *Septuagint* understands by ἀργύριον, not that of *Athens*, but of *Alexandria*, which was double thereunto, and therefore is known by its help: but he adds also, that both these names of Coin, relate to those Golden Pieces coined by *Darius*, and thence named by the Greeks Δαριχοί.

But our best help to understand these Pieces, is from the *Scholiast* on *Aristophanes*, and *Harpocration*, who both affirm, that they weighed as much as the Attick χρυσίδι, which *Pollux* and *Hesychius* assure us weighed two Attick Drachms; that is, by our Account 132, or by *Greaves's* 134 Grains Troy. The forenamed *Scholiast* saith, that the *Darius* who coined these Pieces, was elder than that *Darius* who was *Xerxes* his Father. Now I find no *Darius* elder than him but *Darius* the *Mede*, whom *Daniel* mentions twice; but I find him

him not mentioned by this Name among the Ancients any where else, save in this Passage of the *Scholiast*, and consequently in these Coins, which he explains. And besides, this evinceth it possible and probable, that the chief Fathers of the Jews returning under *Cyrus*, might bring with them much of that Mony, which had been coined by *Cyrus* his immediate Predecessor, to make an Offering to Sacred Uses, as is mentioned *Ezra* 2. 69. where we translate it Drachms; but are to understand, such as *Brerewood* calls *Alexandrian Drachms*, or double Attick Drachms. For each *Daric* contained more than two of our Drachms Troy, which are but 120 Grains; whereas we have shewed these to be about 132, or more.

Now the Weight being stated, the Reduction to the present Value of our Mony, is not difficult: but it must be remembred, that this is not so constant as Weight, but is altered for Reasons of State, more frequently, both in our Kingdom, and in others.

thers. However it's fit to be known, that now, out of every Ounce *Troy* of Gold, taken with its appointed Alloy, there is coined in Gold Coins, the Value of 3 Pounds *Sterling*, 14 Shillings, and 2 Pence: which is expressed in Shillings, and Decimals thereof, thus, *sh.* 74, 1664. Wherefore supposing the *Daric* Gold, and ours of the same goodness, we may find its Value in our Money by this Analogy: As the Ounce *Troy*, which is 480 Grains, is to the *Daric*, which is 132 Grains. So is *sh.* 74, 166, to *sh.* 20, 395. The fourth term shews, that the *Daric* amounts to 20 Shillings, and about 4 Pence, which is about a third part of a Shilling. And by the same method, the whole Sum of *Darics*, which we translate Drachms in *Ezra*, may be computed.

Hottinger hath suggested, that *Darchemon*, is derived from an ancient Persian word *Dram*, signifying both a Coin, and a Weight of twelve *Cherats*: what those were he informs us not; but I find, in *Arias Montanus de Siclo*, the Arabian *Cherat*, to

be derived from the Hebrew *Gerah*, by a usual change of G into Ch, and that it signifies a *Siliqua*, or the Fruit of the *Carob Tree*; and that he weighed twenty such against his *Shekel*, and found them equal thereunto. Hence I gather that each *Cherat* weighed 11 Grains Troy, and therefore twelve of them amounted to 132 Grains; which agrees with our former Investigation of the *Daric*, and shews the Persian Drachm to be just double to the Attick. Now, though I know such a *Cherat* differs much from the Greek *νεογίον*, in *Dioscorides* and *Cleopatra*; yet in this estimate of an Eastern Coin, I prefer *Arias Montanus* his Eyes, and his Scales, attesting the Weight of a *Siliqua*, or *Cherat*, before the Testimony of those Fragments, which in many Instances are corrupted.

Because the Roman Coins mentioned in the New Testament, had some relation to the *Shekel*, being several of them often exchanged for it, and all of them parts of the Roman Ounce, which we have shewed to be

two

two Shekels. I shall briefly on this occasion state their Weight and Value reduced to ours. The only Silver Coin of the Romans, there spoken of, is the *Denarius*; which under the *Cæsars*, in whose time Christ and the Apostles lived, was a little less than the Consular *Denarius*, of which *Greaves* hath writ very learnedly. By help of some of them which have fallen under my examination, and by taking half the Weight of the *Aurei* of such *Cæsars*, which *Greaves* hath given us, and prov'd that their *Denarii* were subduple thereunto; I estimate their Weight to be about 60 Grains of our Troy Ounce. Hence their Value in proportion to our Money (which now hath 62 Pence in an Ounce Troy) is 7 Pence 3 Farthings.

The other Roman Coins mentioned in Scripture, were Copper, and are all known parts of the Roman *As*, or *Affis*; which before, and long after Christ's Time, was just half a Roman Ounce, and so equal in weight to the *Shekel*: but its Value was but the tenth part of the *Denarius*, which is

+ Quoniam si non rather I 3th 16. part. in

But 7 times
to make But
420 grains, so
that's almost
of a Roman
penny falls
short of it 1/2
part of a Roman
ounce: wh. is
stated by Mr
Grew in p. 73
at 438 grains
the 1/2 part
of wh. is 62
1/2 a grain &
4 7/8 of half
a grain.

in our Mony but three Farthings, and a tenth of a Farthing, thus written *f. 3. 1.* Hence it follows, that the *Assarium*, mentioned *Matth. 10. 29*, which is determined by *Cleopatra* to be $\frac{1}{4}$ of the Ounce, must in value of our Coin be *f. 1. 55* a Farthing and an half. Hence also *Quadrans*, mentioned *Matth. 5. 26*, which is $\frac{1}{4}$ of *As*: or $\frac{1}{16}$ of their Ounce, is little above three quarters of our Farthing, exactly $\frac{77}{100}$ Centesimals of it. And half this $\lambda\epsilon\omega\tau\epsilon\nu$, which we translate a *Mite*, is $\frac{38}{100}$ Centesimals of a Farthing, or about a third part of a Farthing; yet was in weight half a Drachm of their Ounce, mentioned *Mark 12. 42*.

" 2 if nebe-
then $\frac{1}{8}$ of an
 $\frac{7}{8}$.

* $\frac{1}{16}$

The Weights less than *Shekel* being thus stated, thereby we shall, secondly, pass to the determination of those which are greater, and may be called Sums of *Shekels*.

I. The *Talent*.

II. The *Maneh*.

I. A

I. A *Talent* was 3000 Shekels, as may be collected by halving the Number of the Israelites (because each one brought half a Shekel) which half of their Number is 301775, and is the Sum of the Shekels which they all contributed. Now *Moses* assures us, *Exod.* 38. 25, 26. that these amounted to 100 Talents, with 1775 Shekels more: wherefore that Number which dividing 301775, will quote 100, and leave 1775 in remainder, is the number of Shekels in a Talent: but only 3000 will do this; therefore 3000 Shekels are a Talent.

Hence we may easily reduce the Talent to Ounces, or Pounds *Averdupoise*, used in Weight among us; for we have shewed two Shekels to be our Ounce *Averdupoise*; therefore 1500 Ounces are in a Talent; which Number divided by 16, the Ounces of a Pound *Averdupoise*, gives the Pounds *Averdupoise* in a Talent, thus $16 \overline{) 1500}$ (93.75. The Quote shews that 93 Pounds and three quarters of a Pound *Averdupoise*, are in a Talent. This

Weight is the same now, and in former Ages: but the Value of this Weight of Silver or Gold, alters in several Ages considerably, as Coins do every where.

However, the Value of a Talent;

1. Of Silver.

2. Of Gold.

In Mony now used, may be thus stated.

1. Every Shekel is in Pence of our present Silver Mony 28,2875, for I now compleat the Decimals of a Penny, formerly omitted in estimate of a single Shekel, as inconsiderable; but now, being to be multiplied by 3000, they will grow considerable, and give the Pence of a Talent to be 84862,5: These divided by 12, give the Shillings thereof 7071,875: The Shillings and Decimals thereof divided by 20, give the Pounds *Sterling*, and parts thereof, £. 353,59375; the Decimals are equal to 11 Shillings 10 Pence half-penny.

2. A Talent of Gold may hence be valued compendiously thus. Gold is now to Silver of the same Weight,
As

Weights and Measures.

121

As 14,356 to 1:

Wherefore multiply the 2 l.

Silver Talent ——— 5353.59375

By ——— 14,356

The Product will be — 5076.191875

Which is ——— 5067 l. 3 s. 10 d.

4 6 3
353 11 10.8

The Value of Gold above Silver hath grown, since the Roman Consuls Time, from 10 to above 14 and a third; and I guess it will grow still higher.

Secondly, and lastly; By help of the *Shekel*, we come to understand the Jewish *Maneh*, which was a round Number of *Shekels*; but with some variety in the Numbers thereof.

The best result of my search into this is, in these two Propositions.

1. That *Maneh* being set for a meer Weight, without respect to Coinage, contained just 100 *Shekels*. This seems clear, by comparing 1 *Kings* 10.17. (where it's said, that in each of *Solomon's* Shields, were three *Manehs*, or, as we translate it, Pounds of Gold).

Gold) with 2 *Chron.* 9. 16. where our Translation affirms, that 3000 *Shekels* of Gold, went to one of those Shields. And indeed, although the word *Shekel* be not in the Original express, yet it must be understood; because *Ezekiel* assures us, *Ezek.* 45. 12. that by the *Shekel*, the *Maneh* was adjusted. And *Pollux*, lib. 9. c. 6. affirms, that when we say a Golden One, we understand a *σάτρη*; as when we say a Silver piece, we mean a *Shekel*, although we express it not.

2. When the *Maneh* is set for a sum of Mony, or Coin, it contains but 60 *Shekels*. To this number the parts of a *Maneh*, in *Ezek.* 45. 12. added together, do amount. And *Josephus*, lib. 14. 12. affirms, the Jews *μνᾶ* (which is derived from *Maneh*) to be two Pounds and an half, which reckoning 12 Ounces to the pound, as the Greeks and Romans in his time did, is just 30 Ounces, which we have shewed to be just 60 *Shekels*: and *Rabbi Gedaliah*, in *Schalsh* agrees with him. Neither is it unusual to take the same word in one sense, when it relates to meet

meer Weight, as we do a Pound (meaning thereby the Pound *Troy*, used in weighing Silver) for 12 Ounces; and in another sense, the same word Pound, when it relates to Money, meaning thereby the Pound *Sterling*; which of Silver Coin contains not quite four Ounces; and of Gold contains not quite the third part of an Ounce. *or current coin.*

I will not digress to consider the great variety of *Mina*, used among the Greeks and Romans; but only suggest that the various import of the word in these Nations, seems to have proceeded from the inconstancy of its signification in the Oriental Tongues, from whence it is derived.

I will conclude with an observation of the Harmony or good Correspondence of the Measures and Weights thus stated. The Cubit will lead to all the Measures, and to the *Shekel*, with the other Weights thence derived: and reciprocally the *Shekel* will lead, not only to the Weights, but to all the other Measures. Thus take the
Cubit

Cubit from the Egyptian Standard ; its Cube is *Ardob* : the sixth of that is *Epha*, whose tenth is *Homer*, its tenth *Cotyla*, its tenth gives an Ounce *Averd.* of Water, half that gives the *Shekel's* weight precisely. So reciprocally take a true *Shekel* (as divers still remain) that doubled gives an Ounce of Water, this ten times is *Cotyla*, this ten times *Homer*, ten such are *Epha*, six *Ephas* an *Ardub*. Its Cube Root will agree with the Standard-Cubit of *Egypt*.

I will conclude this Discourse with the Proposal of a Method, whereby this Doctrine may be made useful to all Nations, most of which are unacquainted with our English Standards of Measure, or Weight, to which only I have made my Principal Reduction in this Book.

This I shall do, by shewing, that either the Jewish Cubit, or our English Foot, may be expressed and understood by a known Proportion to an universal measure, which is either already known, or may easily be found by the diligent enquirer in any Nation :

tion: such is a Thread with a Bullet annexed, adjusted by carefull tryals to that length, that every single vibration of it, will spend just a second Minute; so that it will vibrate 60 times in a first minute. This length will be the same in all Nations and Ages, and may easily enough be found, either by help of a true Pendulum-Clock, or otherwise exactly enough for humane uses. And as its Motion will serve to measure all Time, so its Length, by the help of Arithmetical Operations, and application, may be employ'd to measure all other continued Quantities. Its whole length may be called the Horary Yard, as a third part of it is denominated the Horary Foot, by the Learned Proposer of it, *Hugenius*, in his Treatise *de Horologio Oscillatorio*.

This Length being found in any Nation, may be applied to their usual Measures, whereby it will appear to the Eyes, how it must be expressed in that Nation, as in ours it is expressed by 1 Yard, 3 Inches, 25 Centesimals of an Inch; or by 39 Inches, 25 Centesimals,

tesimals, whereas the Jewish Cubit was found by us to be shorter, viz. 21,888.

Wherefore to find what Proportion, or Rate the Universal Measure hath to the Jewish Cubit, it will be convenient to suppose this Measure divided into Decimal Parts, 10000; and then we may find how many such parts of that Length are in their Cubit, by this Analogy.

As the Pendulum Length in our known Measure, 39,25, is to the Jews Cubit in the same Measure, 21,888, so is the Pendulum's Length in Decimal Parts, 10000, to the Jews Cubit in such Parts, 5576:5. This fourth Proportion gives the Jews Cubit in its Rate to 10000, which are Terms most fit for general use; which was the thing sought for. Now, the Cubit being so determined, the Proportion of the side of an *Epha* answering thereunto, may be found by the Method intimated in the Harmony of Measures lately delivered. And the *Epha* being made 1000 part thereof, will give the Ounce, whose half is the *Shekel*.

Where-

Wherefore by this Method, my labour in reducing these to our English Standard, may become useful to those that know not our Standard, and consequently to all that understand the Language in which it's now written, or into which it may be translated, if it find acceptance,

Corol.

*Corollaries shewing the Uses of this
Discourse of Measures and
Weights.*

1. **T**Hese are sensible Instances of God's care of Justice among Men. These determine every Man's Property, the Bounds of his Land, the Quantity of the Fruits thereof, and the Value of his Mony. Wherefore they are used, both in the first setting out of all Estates, and in all Traffic succeeding thereunto.

2. The fit Measures of the Tabernacle and Temple, to the uses of the whole Nation of the Jews; demonstrate God's early care to settle his People *Israel*, in the form of one entire National Church, under *Moses*, *Aaron*, and the other Priests, who were general officers for all *Israel*. The Church in the Wilderness, mentioned by *St. Stephen*, *Acts* 7. 38. was thus National, and

and is the first collective Body of Men, called a *Church* in the Scripture-Language, by a Man full of the Evangelical Spirit.

Synagogues for particular Neighbourhoods convenience, in the publick Exercise of Religion, were introduced long after, by the pious prudence of the National Governours of the Jewish Church and State, and accordingly were all subordinate to them. It's to be observed also, that this Limited Place for publick National Worship, was within their own Nation; in the midst of their Camp in the Wilderness, in their own Land in *Canaan*. No recourse from it to a Foreign Church by Appeals, but all Differences finally decided within their own Nation, and therein all, even *Aaron*, although the High Priest, and elder Brother to *Moses*, yet was subject to *Moses*, who was King in *Jerusalem*. *Deut 33.5.* By these means all Schismatical setting up of one Altar against another was prevented; National Communion in solemn and decent Piety, with perfect Charity, was promoted;

K which

which being no Shadows, but the most substantial Concerns of Religion, are to be preserved in the Gospel-Times.

3. Hereby is more evidently prov'd the Magnificence, Symmetry, and Beauty that was in the Structure of the Temple; and the liberal Maintenance which God provided for the Levites his Ministers. For if the Cubit by me propos'd, determine the *Area*, both of the Temple, and of the Priests Suburbs (as the Scripture sets them both out by Cubits) they must be much longer, than if they were set out by so many shorter Cubits (suppose Cubits of 18 inches) in such proportion as the Squares of these different Cubits bear to each other: by the 19 & 20 *Prop. of Euclid's 6th Book*. But the Squares of these different Cubits are in foot-measure, which is here more convenient, as 3,82 to 2,25: the bigger of which, is near half as much more as the less. Therefore the *Areas* of the Temple, and of the Priests Suburbs, are according to my Measure

sure, near half as big again, as they would be if determined by that shorter Cubit.

Such greatness of the Temple *Solomon* intimates to the King of *Tyre* to be requisite, as best suiting with the Greatness of God, 2 *Chron.* 2. 5. This Reason alledged by *Solomon* to a Heathen, must be of moral or natural, and therefore perpetual Force, continuing to Evangelical Times; and therefore intimating to us, that even now magnificent and stately Buildings are usefull meanes to signify what great and honourable Thoughts we have of God, and design to promote in those that come to the Places of his Publick Worship. And from God's liberal provision of Land in the Levites Suburbs, besides other Advantages, we are taught, by *St. Paul*, that even so those that preach the Gospel, should live of the Gospel, 1 *Cor.* 9. 14.

4. The Fitness, Safety, and Honour, of keeping constantly to the use of such indifferent Things, as
K 2 have

have been determined by Law or Custom, is clearly proved by the constancy of *Israel's* using those Measures (altho others might be assigned, as the Greek or Roman Measures, to serve the same Ends) from the Time of *Moses*, and probably before, to the Captivity and after. And this notwithstanding they were used by the Egyptians and Canaanites, which altered not their Nature in the least. And this Instance proves undeniably, that such indifferent practices, as the use of these Measures, may be highly useful to the greatest Moral Duties, the Publick Honour of God, and the Preservation of Justice among men.

These Corollaries hold useful (excepting the Third, which bears upon the largeness which I have assigned) notwithstanding there may be supposed some mistake in my Determination of the Bigness of these Measures. But I hope my Reasons will justify that also.

Besides

Besides these Uses, it seems to me considerable, that the knowledg of Weights, Measures, and Coins, together with that of Numbers of all their Parts and Proportions to each other, is the prime and most obvious Instance of something peculiar to Mankind above all other living Creatures, enabling Men more than them, to civil Society, mutual Commerce and Aid to each other thereby, above all that is found in the low Correspondencies of Brutes. And agreeably to this peculiar Skill of Mankind in Numbers and Measures, we may remark, that the best Sciences which we have, *viz.* Arithmetick and Geometry, and our most perfect Arts, I mean, the Geometrical Doctrines of Mechanicks and Staticks, are all employ'd in this Matter, founded in the Principles of Numeration, and Mensuration, and built up by a close order and coherence of Demonstrations, such as no where else are to be found. This was, I confess, the first Motive that made me take so much pains to retrieve these Scripture-Numbers, Measures,

and Weights, which are the most ancient of all whereof we have any Memoires.

Lastly; The Harmony of these Measures and Weights, so stated, will evince the Wisdom of the Ancients (probably *Noah*, or the *Antediluvian* Men) in the first constitution of them, confirms the Truth of our investigation of them, and will ease all our Memories in retaining them, and shews that some degree of Mathematical Learning was requisite, or highly commendable in the Mosaical Priests, who were to be Overseers of their Measures and Weights.

A Table

A Table of the Principal Measures, &c. herein contained.

I. Of Length.

1. The Jews Cubit in English Inches ————— } ^{Inch Decim.} 21,888

Hence are deduced ;

1. Its Parts, or less Measures.

Zereth, the Span, $\frac{1}{2}$ a Cubit	10,944
A Palm, Hands-breadth, $\frac{1}{3}$	3,648
A Digit, Fingers-breadth, $\frac{1}{4}$	912
The East used also a Span $\frac{1}{2}$	} 7,296
$\frac{1}{3}$ of a Cubit, —————	

2. Aggregate Numbers of Cubits.

	^{Eng. Feet & Dec.}
ορνια, a Fathom, 4 Cubits	7,296
Ezekiel's Reed, 6 Cubits	10,944
The Arabian Canna, or Pole, 8 Cubits —————	} 14,592
Schenus, the ancient Measuring Line or Chain, 80 C.	
Sabbath days Journ. 2000 Cub.	3648
K 4	The

	Fect.	Mil.Engl.
The Eastern Mile 4000 Cubits	— 7296 —	— 13816 —
The Parasang, — 12000 Cubits	— 21888 —	— 41454 —
The 30th part thereof is a Stadium, as Herod. and Hesychius witness, — 400 Cubits,	} — 13816 —	7296 feet Eng.
the 11th part of an Eastern Mile		
Their days Journey not always equal, but set by Abulfeda at a middle rate, eight Parasangs, or	} — 331632 —	
96000 Cubits		

II. Table

Table of Measures of Capacity.

Compare with p. 102
66 where it is pointed
out that a little difference
exists between the two Ephas.

	Sol. Inches.	Wine Gal.	P.	Sol. Inch.
Epha, or Bath,	174,77	7	4	15,2
Corus, or Chomer, viz. 10 Ephas	17477	75	5	7
Seah the third of Epha	582,5	2	4	3
Hin the sixth	291,25	1	2	1,5
Homer the tenth	174,77	0	6	0,5
Cab the eighteenth	97,03	0	3	10
Log the seventy-second	24,25	0	0	24,2

Add the Syrian *μετρηταις* — *Corgio Romano* — in solid Inches — 207,06 — 7 Pints
English Wine-measure, and about half a quarter of a Pint.

III. A

III. A Table of Weights and Coins.

But if ye Remon ouner ~~system~~ as ~~of~~ ~~the~~ ~~author~~ ~~held~~
 only ~~down~~ ~~Donary~~ ~~of~~ ~~it~~ ~~shall~~ ~~centimes~~ ~~francs~~ ~~Donary~~
 a ~~shaken~~ ~~with~~ ~~Donary~~ ~~above~~
 too 2080
 English.

an ouner

As on page.

56 $\frac{1}{2}$

$\frac{1}{4}$ of a far
 thing

The Shekel of Silver just half a Roman Ounce---To half our Averdupoise Ounce, in Troy Grains---219, in value of our Mony, pence 28, 28, that is, 2 Shillings, 4 Pence Farthing, with three Centesimals of a Peny above it, which are near $\frac{1}{4}$ th part of a Farthing.

Hence the half and quarter of Shekel are known.

Half a Shekel is called *Bekah*.

Its twentieth part, called *Gerah* and *Agurah* (well translated by *Obolus Atticus*) and *Keshitah*.

Hence a Talent of Silver---3000 Shekels, is in our Silver Coin,

l. 353.59375, or 353 l. 11s. 10d. ob.

Talent of Gold, 5076 l. 3s. 10d.

Hence *Maneh* in meer Weight, 100 Shekels, in Coin 60.

The Golden *Darics*, or Persian *Darchemons*, 12 *Gerahs*, value 1 l. 0. 4 d.

The

The Roman Silver *Denarii*--7 d. 3 far.
Gold Coins double in Weight.

Their Brazen or Copper *Asses*, $\frac{1}{2}$ ounce
Weight, in value 3 Farthings, and
1 tenth of a Farthing.

Half this was *Assarium*, 1 Farthing,
and 55 Centesimals of a Farthing.

Hence *Quadrans* is little above 3 quar-
ters of our Farthing in value: And
half this, called λεπτόν, translated a
Mite, is about 1 third of our Far-
thing in value.

POSTSCRIPT.

BEcause my exactest determination
of the *Epha* is founded in the pro-
portion of $\frac{1}{2}$ which it bore to the E-
gyptian *Ardub*, the Cube of their Cu-
bit; I entreated my Learned Friend,
Dr. *John Moore*, to enquire of Dr. *Po-
cock*, the great Oracle in Eastern Learn-
ing, whether or no he had met with
any other Authority, besides what I
have before mentioned, whereby that
pro-

proportion may be proved. In his obliging Answer, which came after my Book was finish'd, I find that he hath confirmed it, from the chief Arabian Lexicographer, the Author of the Dictionary called *Kamus*; who expressly affirms *Ardob* to be a great Egyptian Measure, containing six *Waibahs*. And he hath also confirmed my Judgment, that *Waibah*, or *Oeba*, is the same with *Epha*, by the Authority of *Abu Walid* the great Grammarian.

THE END.

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v. Purnand do Purnand

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Zorile u span

The Advantage of arguing or collecting from great
numbers rather than small 64 65 & 71

m. Tab: Monstruosa Capacitatis. ex Letherton

Cochlear	46090	6912	3456	2304	1152	786	288
Cyathus	10520	1728	864	576	288	192	72
Acrotolus	7680	1152	776	384	192	128	48
Homina	9920	288	144	26	48	32	12
Sylon	960	144	72	48	24	16	6
Longius	160	10 $\frac{1}{2}$	12	5 $\frac{1}{2}$	4	2 $\frac{1}{2}$	1
Modius	60	6	4 $\frac{1}{2}$	3	1 $\frac{1}{2}$	1	26 $\frac{1}{2}$
Urna	40	4	3	2	1	40 $\frac{1}{2}$	
Amphora	20	2	1 $\frac{1}{2}$	1	60 $\frac{1}{2}$		
Codrus	13 $\frac{1}{3}$	1 $\frac{1}{3}$	1	120 $\frac{1}{2}$			
Modinus	10	1 $\frac{1}{3}$	160 $\frac{1}{2}$				
Culeus	1	1600 $\frac{1}{2}$	non furs. l. ut dicit	Garr. Agreda	p. 72		

Grata. ligo modinus 1. continet (non 10 $\frac{2}{3}$ sed) 16 con
quia cadau dicitur continere 12 longior
Q. ubi uisus est continere off Amphora ut si u. hold 80
pound. tunc u. should hold 80 longior et non 5 $\frac{1}{2}$ or
in u. table.

These parts of an uncia from Robt Cenal's p. 144

- $\frac{3}{8}$ uncia
- $\frac{3}{8}$ romuncia
- $\frac{3}{8}$ drachma fms romina sex lula
- $\frac{3}{4}$ siciliques sic dictus qd unciam fecit
- $\frac{3}{8}$ sex lula
- $\frac{3}{8}$ denarius
- $\frac{3}{8}$ Drachma
- $\frac{3}{24}$ scriptulum

Q^m if as far as I could find by triall
a wine pint of water weighs 17 uncies
two drachms - & but 13 uncies when filled
with wheale

266
72
46
12
6
1
26

gned
p. 72
16

80
1/4

8
144

L

see p.
144

